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ABSTRACT

Under the California Assembly Bill 665 of 1972, the state assessment program must test all students in grades 1, 2, 3, 6, and 12 in reading skills, and those in grades 6 and 12 to assess their skills in effectiveness of written expression, spelling, and mathematics. The state may develop its own tests, and a matrix sampling approach may be used for collecting data. This document deals with the test content specifications in mathematics. Operationally, the basic skills in mathematics were defined by a matrix consisting of five traditional mathematical content areas and three levels of cognition. The five mathematical content areas are arithmetic, algebra, geometry, measurement, and probability and statistics. The three cognitive levels are computation and knowledge of facts, comprehension, and application. Items that provided a sampling throughout the matrix were chosen for the testing program from a pool supplied by cooperating test publishers. (BW)

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Test Content Specifications for the Survey of Basic Skills

Mathematics

GRADES SIX AND TWELVE

Test Content Specifications
for the Survey of Basic Skills

Mathematics Grades Six and Twelve

Prepared under the direction of
Alexander I. Law, Chief
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CALIFORNIA STATE DEPARTMENT OF EDUCATION • Wilson Riles—Superintendent of Public Instruction • Sacramento, 1975

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Preface

Assembly Bill 665 of 1972 brought about several changes in the statewide testing program. The new assessment program, like the former statewide testing program, requires that all students in specified grades in California be tested annually in the basic skill areasof reading, effectiveness of written expression (formerly "grammar"), spelling, and basic mathematics. Under the old law, students were tested at grades one, two, three, six, and twelve to assess their reading skills, and students were tested at grades six and twelve to assess their skills in effectiveness of written expression, spelling, and mathematics. Under AB 665, testing is still conducted at the same grades and in the same areas; the exception is that the grade one reading test has been replaced by the Entry Level Test, which is designed to measure a child's skills when he or she enters the first grade.

Other significant changes under the new law are that California may develop its own tests and that a matrix sampling approach may be used for collecting the test data. With matrix sampling, each student takes a small portion of the test rather than the complete test. While this method of data gathering does not yield reliable information for each student, it does provide reliable data at the school, district, and state levels.

The intent of the legislation which permits the Department of Education to develop its own tests is to ensure that the tests be directly related to the curriculum content of most instructional programs in California schools. In developing the new tests, the Department first developed a framework of the test content which could be used to guide persons in constructing valid instruments to measure specified skills. This publication is one of the documents the Department of Education developed for the purpose of constructing valid testing instruments; it delineates the test content specifications for the mathematics section of the Survey of Basic Skills for grades six and twelve. The Department developed similar documents for the areas of reading and of effectiveness of written expression and spelling. They may be obtained from the Department's Office of Program Evaluation and Research upon request (721 Capitol Mall, Sacramento, CA 95814).

On January 22, 1973, the Department of Education extended invitations to persons well-known in the field of mathematics education to serve on the statewide Mathematics Assessment Advisory Committee to develop the test content specifications for the statewide assessment program. The persons invited were all experts in the field of mathematics who were either professors in private or public universities, curriculum specialists, administrators, or mathematics teachers. We are indebted to this dedicated group of persons for their time and talents to improve the state assessment program.

Donald R. McKinley
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Contents

Preface iii

Mathematics Assessment Advisory Committee iv

Development of the Test Content Specifications for California's Survey of Basic Skills 1

Scope of Basic Skills in Mathematics 1
Organization of the Test Content Specifications 3
Test Construction from Test Item Specifications 3
Use of Metric and U. S. Customary Units 4
Reporting Categories for the Survey 5
Use of the Test Content Specifications 6

California Assessment Program Test Content Specifications for the Survey of Basic Skills 7

1.0 Subcontent Area: Arithmetic Computation 7
1.1 Skill Area: Addition-Subtraction of Whole Numbers 7
1.2 Skill Area: Multiplication and Division of Whole Numbers 8
1.3 Skill Area: Addition-Subtraction of Rational Numbers 9
1.4 Skill Area: Multiplication and Division of Rational Numbers 11
1.5 Skill Area: Conversion of Rational Numbers from One Form to the Other 14

2.0 Subcontent Area: Arithmetic Comprehension 16
2.1 Skill Area: Numbers and Numerals 16
2.2 Skill Area: Properties of Operators 20
2.3 Skill Area: Number Theory 22
2.4 Skill Area: Arithmetic Operations 24

3.0 Subcontent Area: Applications in Arithmetic 26
3.1 Skill Area: Arithmetic Operations of Whole Numbers 26
3.2 Skill Area: Arithmetic Operations of Rational Numbers 29
3.3 Skill Area: Arithmetic Operations Using Ratio, Proportion, and Percentage 31

4.0 Subcontent Area: Algebraic Computation 34
4.1 Skill Area: Algebraic Linear Equations 34

5.0 Subcontent Area: Algebraic Comprehension 36
5.1 Skill Area: Algebraic Expressions and Formulas 36
5.2 Skill Area: Number Sentences -- Linear Equations 37
5.3 Skill Area: Functions and Graphs 38

6.0 Subcontent Area: Algebraic Applications 40
6.1 Skill Area: Mathematical Sentences and Formulas 40
6.2 Skill Area: Mathematical Functions and Graphs 41

7.0 Subcontent Area: Geometric Knowledge of Facts 48
7.1 Skill Area: Geometric Figures 48
7.2 Skill Area: Geometric Symbols, Terms, and Postulates 50

8.0 Subcontent Area: Geometric Comprehension 51
8.1 Skill Area: Components of Geometric Figures 51
8.2 Skill Area: Geometric Properties and Postulates 52
8.3 Skill Area: Relationships Between Geometric Sets 54

9.0 Subcontent Area: Applications of Geometric Knowledge of Facts and Concepts 57
9.1 Skill Area: Point and Locus of Points 57
9.2 Skill Area: Geometric Properties and Relationships 58

10.0 Subcontent Area: Measurement Knowledge 60
10.1 Skill Area: Estimation -- Length, Area, Capacity, and Conversion Factors 60
10.2 Skill Area: Arithmetic Operation on Denominate Numbers. 65

11.0 Subcontent Area: Measurement Comprehension 67
11.1 Skill Area: Estimation -- Length, Area, Capacity, and Mass 67
11.2 Skill Area: Measurement of Geometric Shapes 68
11.3 Skill Area: Functional Measurement 71

12.0 Subcontent Area: Measurement Applications 73
12.1 Skill Area: Arithmetic Operations on Denominate Numbers 73

13.0 Subcontent Area: Probability and Statistics--Computation and Knowledge of Facts 80
13.1 Skill Area: Probability 80
13.2 Skill Area: Statistics 80

14.0 Subcontent Area: Probability and Statistics --Comprehension 82
14.1 Skill Area: Probability of Simple Event 82

15.0 Subcontent Area: Probability and Statistics --Applications 84
15.1 Skill Area: Probability 84
15.2 Skill Area: Statistics 85

Development of the Test Content Specifications for California's *Survey of Basic Skills*

The Mathematics Assessment Advisory Committee, which assumed the responsibility for developing the test content specifications for California's Survey of Basic Skills, began its task by developing a comprehensive list of objectives from available sources: publishers' mathematics objectives, Mathematics Framework for California Public Schools, scope and sequence charts of state-adopted textbooks, and objectives of California school districts. One of the committee members was then assigned the task of synthesizing these objectives and putting them in a form which would serve as a basis for further discussion by the full committee. The committee discussions led to the delineation of the number of objectives and the cognitive level at which those objectives were to be tested. Since it was known that the major purpose of the objectives was to form a basis for the selection of test items from the pool of items to be submitted by the test publishers, the objectives needed to be recast in a format which made it possible to 'key' the publisher's items to the exact intent of the committee members. Four of the committee members took the responsibility of transforming the objectives into the present format.

The draft of test content specifications was then mailed to approximately 200 randomly selected school districts in California for their review and comments. They were asked to address themselves specifically to three questions pertaining to each item specification:

(1) Does the skill relate to the subcontent category?
(2) Is the skill relevant to the district's mathematics program?
(3) Should the skill be measured as part of the basic mathematics testing program for the assigned grade?

The districts were provided with a working definition of basic mathematics and with a general outline of the statewide assessment plan. A total of 69 percent of the districts returned their comments to the Office of Program Evaluation and Research, which summarized the districts' responses. The test content specifications were modified to reflect the concerns of the districts. These modifications consisted primarily of the deletion of test items designed to measure certain skills when a substantial number of districts responded that those skills should not be measured as part of the California Assessment Program.

Some test content specifications appearing in the charts of this document are marked by an asterisk (*) in the grade level column of skill areas 6.26 and 14.1 through 15.2 to indicate that they were not included in the 1973-74 version of the Survey of Basic Skills. However, the committee will consider the inclusion of those specifications when the test is revised.

SCOPE OF BASIC SKILLS IN MATHEMATICS

The following working definition of the basic skills in mathematics was agreed upon by the committee members and served as the basis for developing the test content specifications:

> Basic skills in mathematics are those skills necessary for functioning as a productive citizen in today's society. The skills referred to are the arithmetic processes needed for using the four fundamental operations as they relate to computation, comprehension,

and application of whole numbers, common and decimal fractions, and those processes used in measurement, probability and statistics, and algebraic and geometric functions.

Operationally, the basic skills in mathematics were defined by the number of objectives or skill areas assigned for each cell of a matrix consisting of five traditional mathematical content areas and three levels of cognition.[1] The five mathematical content areas are arithmetic, algebra, geometry, measurement, and probability and statistics. The three cognitive levels are computation and knowledge of facts, comprehension, and application. The number of skill areas to be assessed in each cell of the matrix are identified in Table 1.

The scope of the skill areas to be assessed in each cell of the matrix, as shown in Table 1, was guided by the purpose of the statewide testing program: evaluating the mathematics programs in California schools and thus providing information about the strengths and weaknesses of those programs. Therefore, the scope of the skill areas to be assessed was designed to include all subject matter areas of a "good" program as defined by the Mathematics Framework for California Public Schools and the state-adopted textbooks. Furthermore, since the legislation required an assessment only in the "basic" skills, it was decided that the grade twelve test would be limited to those topics covered in programs for grades one through eight. The nature of the test items for grade twelve involve problems appropriate for students at that grade level, keeping the vocabulary level as simple as possible.

1 See School Mathematics Study Group, Newsletter Number 38, August, 1972, for a definition of the cognitive levels.

Table 1

Number of Subskill Areas to be Assessed in the Survey of Basic Skills, Displayed According to Mathematical Content and Cognitive Levels*

MATHEMATICAL SUBCONTENT AREAS	COGNITIVE LEVELS: Computation and Knowledge of Facts	Comprehension	Application
Arithmetic (Numbers and Number Operations)	16	26	9
Algebra	6	6	8
Geometry	7	4	3
Measurement	9	8	2
Probability and Statistics	3	2	4

*Although there is a high degree of overlap among the subskill areas of grades six and twelve, not all subskill areas are assessed at both grade levels.

ORGANIZATION OF THE TEST CONTENT SPECIFICATIONS

In order to establish a known order to the test content specifications, it was necessary to assign certain terms to the areas and skills under examination. For example, the term content area was selected for the four areas of reading, effectiveness of written expression, spelling, and mathematics. The term subcontent area has been used to refer to the parts of mathematics known as arithmetic, algebra, geometry, measurement, and probability and statistics. Each cell or subcontent area is comprised of several subskill areas, and each subskill area is comprised of several subskills. A number designation has also been used to represent these skills. (See Table 1 for the number of skill areas to be assessed, and see the charts beginning on page 7 for specific illustrations of the use of the items.)

The designations subcontent area, skill area, subskill area, and subskill represent a hierarchy of skills from the broadest to the narrowest levels. The purpose of narrowing down the skill was twofold. First, the committee members were able to express precisely which skills they intended to have measured. Second, the test items could be constructed to measure precisely the skills identified by the committee.

As an example, the first cell of the matrix shown in Table 1, which represents the subcontent area of arithmetic computation, has been broken down into finer levels, as follows:

1.0 Subcontent Area: Arithmetic Computation
- 1.1 Skill Area: Addition-Subtraction of Whole Numbers
  - 1.11 Subskill Area: Sum of two or more whole numbers
    - 1.11(a) Subskill: Involving two numbers with 3-digit numerals, no renaming

The subskill identified in the preceding illustration specifies quite precisely what is desired to be measured by the test item. It may also be noted that in a column labeled Performance Mode of the test content specifications charts, the expected student performance with a subskill is identified. The subskill and the performance mode together are called the Item Specification. Illustrative test items are also provided for each item specification in the Example column of the charts beginning on page 7 of this publication.

It is to be emphasized that these illustrative examples of items are not the actual test items, nor do they necessarily indicate exactly how many problems should be attached to each subcontent. These specifications served as a convenient vehicle to request items from various test publishers or other sources of test items.

TEST CONSTRUCTION FROM TEST ITEM SPECIFICATIONS

Several steps were involved in developing the Survey of Basic Skills from the test content specifications. First, the test content specifications were sent to several test publishers who agreed to submit to the Department items from their nationally used tests. Each item of the large number of items received was coded according to item specification. However, the quantity of items submitted was not equal for all categories; in fact, some categories were not represented at all. Relatively large numbers of items were submitted for the more conventional categories, such as arithmetic computation; small numbers of items were submitted for such categories as comprehension and probability. Gaps in some of the categories were filled in by the items from the State of California Inventory of Mathematical Achievement (SCIMA).

A test item review committee of elementary and high school mathematics teachers from throughout the state was assigned the task of item review and screening. The teachers worked under the direction of two members of the statewide Mathematics Assessment Advisory Committee. Each item was reviewed by two groups, each group consisting of one elementary and one high school teacher. The review process consisted of a verification or reassignment of items to categories of item specification; the members of the committee looked for possible miscuing and, in general, verified the items. If an item was not judged similarly by the two groups, the item was judged by a third group to resolve the disagreement. Since most of the items were from the test batteries of the publishers and had been in use for several years, only a very small fraction (less than 3 percent) of items were actually eliminated. However, approximately 10 percent of the items required recategorization.

The items selected by the test item review committee formed the basis for the construction of the Survey of Basic Skills. In deciding the number of items to be included in the survey, three considerations were made:

1. The proportion of mathematics items as compared to items for the areas of reading and written expression should be approximately the same as that found in most commonly standardized tests developed by publishers.

2. Each form could be administered within a class period.

3. The decision to use a certain number of forms (14 for grade six and 18 for grade twelve) was made, keeping in view both cost and the statistical considerations affecting the precision of the scores for reporting to schools and districts.

An examination of the list of item specifications will reveal that considerably smaller numbers of items were included in the test than there were item specifications. A proportionate and random selection of specifications would have been desirable, but this was not always possible. A major restriction was that items for all specifications were not available, and wherever possible, items with p-values of less than 0.20 were not considered suitable. The overall proportion of items in the major categories, however, was the same as that decided by the advisory committee for each of the subcontent areas and each of the cognitive levels of knowledge, comprehension, and application.

USE OF METRIC AND U.S. CUSTOMARY UNITS

The item specifications for the subcontent area of measurement include examples that involve both U.S. Customary and SI metric (International System of Units) units. Although the Survey of Basic Skills still uses conventional spellings and notations in examples of metric units, the charts in this document use SI metric spellings and notations; e.g., centimetre instead of centimeter, 1 321 instead of 1,321. As the state moves to metrics, the number of metric items included in the Survey of Basic Skills will be increased. It is expected that the change in the test items from U.S. Customary Units of Measure to SI metrics will follow the tiretable given in the 1975 edition of the Mathematics Framework for California Public Schools.

REPORTING CATEGORIES FOR THE SURVEY

The reporting categories for the Survey of Basic Skills are the subcontent areas which are identified in Table 2. For reporting purposes, however, the categories are not always the same as the subcontent; sometimes several subcontent areas have been combined to make a single reporting category. The results at the state level will be reported at a finer level than will those to be reported at the school and district levels. The X's in Table 2 indicate the reporting levels for schools, districts, and the state. The number of test items included in the Survey of Basic Skills that correspond to the various subcontent categories are also listed in Table 2. It should be noted that all categories are not equally represented in all the forms of the Survey. However, the overall difficulty level of the items is approximately equal across all forms of the Survey, which has been developed for use in California's public schools.

Table 2

Reporting Levels and the Number of Items for Each Reporting Category in the Survey of Basic Skills

Subcontent categories	Reporting level		Number of items in the Survey	
	State	School and district	Grade 6	Grade 12
Arithmetic Skills	x	x	84	98
Number Concepts	x	x	24	28
Numeration	x		12	14
Number Theory	x		6	8
Properties of numbers	x		6	6
Whole Numbers	x	x	20	22
Computation & Comprehension	x		12	14
Applications	x		8	8
Fractions	x	x	20	26
Computation & Comprehension	x		12	14
Applications	x		6	8
Ratio and Proportion	x		2	4
Decimals	x	x	20	22
Computation & Comprehension	x		12	12
Applications	x		6	8
Ratio and Proportion	x		2	2
Algebraic Skills*	x	x	--	32
Computation & Comprehension	x		--	14
Applications	x		--	18
Geometric Skills	x	x	28	24
Knowledge Skills	x		14	12
Comprehension & Applications	x		14	12
Measurement, Functions, and Graph	x	x	44	30
Knowledge and Comprehension	x		20	12
Applications	x		24	18
Probability and Statistics	x	x	12	14
Computation	x		6	6
Comprehension & Application	x		6	8
Total			168	198

*Scores for these skills will be reported in reports for grade twelve only.

USE OF THE TEST CONTENT SPECIFICATIONS

The test content specifications outlined in the charts appearing on the pages that follow served as a blueprint in developing the statewide assessment instruments. In that sense, they have served their chief purpose. They were also designed and have been made available for another important purpose: to assist school personnel in interpreting the results of the Survey of Basic Skills. The report of results will show strengths and weaknesses of school programs. However, before a low score in a given skill area can be interpreted to indicate a weakness of the program, one critical question must be answered: Is the mastery of that skill included in the local set of instructional objectives? For example, if a school does not include in its program any training in the area of probability and statistics, the children in that school could be expected to have low scores in that area, but it does not mean that the program as a whole is ineffective.

Although the specifications for the Survey of Basic Skills are based upon the 1975 edition of the Mathematics Framework for California Public Schools and upon the objectives of most instructional programs in California schools, they are not meant to be exhaustive. Some districts may want to focus on skill areas which received little emphasis in the specifications. It is recommended that the direction for improving a district's mathematics curriculum should be derived from the Mathematics Framework for California Public Schools and the various documents designed to help districts implement the framework. The specifications should be used in conjunction with those sources.

Finally, there may be a temptation to use the sample test items as a convenient set of practice exercises to help the students "brush up" before the testing period. Since the actual test items are "keyed" to these specifications, any attempt to use the materials in that way is both unethical and in direct conflict with Section 12829 of the California Education Code, which states that, "With the exception of physical performance tests, no city, county, city and county, or district superintendent of schools or any principal or teacher of any elementary or secondary school under his charge shall carry on any program of specific preparation of pupils within the district for the testing program as such or the particular test used therein."

California Assessment Program
Test Content Specifications for the *Survey of Basic Skills*
Grades Six and Twelve — Mathematics

1.0 SUBCONTENT AREA: ARITHMETIC COMPUTATION

1.1 ***Skill Area:*** Addition-Subtraction of Whole Numbers

Level	*Subskill Area*	*Illustrative Item Specification*		*Grade Level*	*Example*
		Subskill	*Performance Mode*		
1.11	Determine the sum of two or more whole numbers.	a. Involving two numbers with up to 3-digit numerals: i) no renaming	Naming the sum, vertical form	6 & 12	23 +46 (A) 68 (B) 69 (C) 78 (D) 79 (E) Not given
		ii) renaming ones as tens and/or tens as hundreds	Naming the sum, vertical form	6	53 +61 (A) 104 (B) 114 (C) 411 (D) 115 (E) Not given
		b. Involving two numbers with 3-digit numerals, renaming ones as tens, tens as hundreds, and hundreds as thousands	Naming the sum, vertical or horizontal form	6	572 +759 (A) 1 331 (B) 121 211 (C) 227 (D) 1 227 (E) Not given (See note on metrics on page 4.)
		c. Involving three numbers each with single digit numeral	Naming the sum, horizontal form	6 & 12	8+7+9=□ (A) 22 (B) 23 (C) 24 (D) 25 (E) Not given
		d. Involving 4 or 5 numbers with 2- or 3-digit numerals, renaming	Naming the sum, vertical form	6 & 12	989 656 578 799 +585 (A) 4 607 (B) 3 607 (C) 3 707 (D) 3 617 (E) Not given
		e. Involving 3 or 4 numbers with 2-, 3-, and 4-digit numerals, renaming	Naming the sum, horizontal or vertical form	6 & 12	497 79 9 856 + 778 (A) 10 210 (B) 11 210 (C) 9 210 (D) 11 220 (E) Not given
			Naming the sum, given verbal operational direction	12	Find the sum of 3 291; 857; 37; 7609; and 870. (A) 12 664 (B) 12 675 (C) 11 674 (D) 11 665 (E) Not given
1.12	Determine the difference of two whole numbers.	a. Involving a 2-digit and a 1-digit numeral, no renaming	Naming the difference, vertical form	6 & 12	39 - 6 (A) 45 (B) 36 (C) 33 (D) 29 (E) Not given
		b. Involving 2-digit numerals, no renaming	Naming the difference, vertical form	6	43 -13 (A) 20 (B) 56 (C) 30 (D) 36 (E) Not given
		c Involving up to 4-digit numerals: i) no renaming	Naming the difference, vertical form	6	869 -346 (A) 523 (B) 1 215 (C) 503 (D) 423 (E) Not given
		ii) renaming	Naming the difference, vertical form	6 & 12	621 -414 (A) 207 (B) 217 (C) 206 (D) 216 (E) Not given

1.1 ***Skill Area:*** Addition-Subtraction of Whole Numbers (Cont.)

1.12 (Cont.)	Determine the difference of two whole numbers.	iii) renaming tens as ones and hundreds as tens with a "1" or a "0" in tens place	Naming the difference, vertical form	6	315 (A) 37 (B) 27 (C) 23 (D) 123 -288 (E) Not given
				6 & 12	503 (A) 318 (B) 728 (C) 418 (D) 328 -185 (E) Not given
		d. Involving a 4-digit and a 3- or 4-digit numeral, renaming	Naming the difference, vertical form	6 & 12	3 258 (A) 3 100 (B) 3 080 (C) 3 180 - 178 (D) 3 086 (E) Not given
		e. Involving 3- or 4-digit numerals, with "0" in tens or hundreds place of the sum and tens place of the addend, renaming	Naming the difference, horizontal/vertical form	6 & 12	6 005 (A) 298 (B) 198 (C) 288 (D) 188 -5 807 (E) Not given
		f. Involving 2- to 5-digit numerals	Naming the difference, given verbal operational direction	12	Find the difference between 16 836 and 12 689. (A) 4 148 (B) 4 046 (C) 4 146 (D) 4 147 (E) Not given

1.2 ***Skill Area:*** Multiplication and Division of Whole Numbers

1.21	Determine the product of two whole numbers.	a. Involving a 2-digit and a multiple of 10 factor	Naming the product, vertical or horizontal form	6	32 (A) 42 (B) 320 (C) 3200 (D) 22 x10 (E) Not given
		b. Involving a 3-digit and a 1-digit factor, no renaming	Naming the product, vertical or horizontal form	6 & 12	432 (A) 874 (B) 964 (C) 864 (D) 974 x 2 (E) Not given
		c. Involving a 2- or 3-digit and a 1- or 2-digit factor, renaming	Naming the product, vertical or horizontal form	6	36 (A) 216 (B) 42 (C) 186 (D) 378 x6 (E) Not given
		d. Involving a 3-digit and a 2-digit factor, renaming	Naming the product, vertical or horizontal form	6 & 12	456 (A) 13 124 (B) 13 024 (C) 12 124 x 29 (D) 13 125 (E) Not given
		e. Involving a 3-digit and a 2-digit factor, all digits between 5 and 9, renaming	Naming the product, vertical or horizontal form	6 & 12	987 (A) 66 129 (B) 67 139 (C) 66 229 x 67 (D) 67 119 (E) Not given
		f. Involving 2- or 3-digit factors, one factor having "0" in tens place	Naming the product, vertical or horizontal form	6 & 12	636 (A) 132 288 (B) 13 228 (C) 132 238 x208 (D) 123 238 (E) Not given
		g. Involving up to 4-digit factors, having "0" in tens and/or hundreds place	Naming the product, vertical form	6 & 12	6 005 (A) 34 880 135 (B) 34 871 035 x5 807 (C) 34 881 035 (D) 34 871 135 (E) Not given
		h. Involving two factors	Naming the product, given verbal operational instructions without multiplication sign	12	Find the product of 84 786 and 9 653. (A) 818 439 258 (B) 818 440 258 (C) 818 419 158 (D) 817 439 168 (E) Not given

1.2 ***Skill Area:*** Multiplication and Division of Whole Numbers (Cont.)

1.22	Determine the quotient and remainder in division of two whole numbers.	a. Involving a 2-digit product and a 1-digit factor, no remainder	Naming the missing factor, short form	6	$9\overline{)63}$	(A) 6 (B) 7 (C) 8 (D) 7.5 (E) Not given
		b. Involving a 3-digit multiple of 10 product and a 2-digit multiple of 10 factor	Naming the missing factor, short form	6	$40\overline{)280}$	(A) 7 (B) 7 R10 (C) 8 (D) 8 R10 (E) Not given
		c. Involving a 3- or more digit product and a 1-digit factor	Naming the missing factor, short form	6 & 12	$3\overline{)639}$	(A) 231 (B) 203 (C) 213 (D) 233 (E) Not given
		d. Involving a 2-digit product and a 1-digit factor, remainder	Naming the missing factor and remainder	6 & 12	$7\overline{)45}$	(A) 6 R2 (B) 6 R3 (C) 7 R1 (D) 7 R2 (E) Not given
		e. Involving a 3-digit product and a 2-digit factor, remainder	Naming the missing factor and remainder	6 & 12	$87\overline{)350}$	(A) 4 R2 (B) 4 R12 (C) 3 R9 (D) 3 R2 (E) Not given
		f. Involving a 4- or 5-digit product and a 2-digit factor: i) no remainder	Naming the missing factor	6 & 12	$48\overline{)14640}$	(A) 325 R40 (B) 305 (C) 336 R32 (D) 315 (E) Not given
		ii)remainder	Naming the missing factor and remainder	6 & 12	$76\overline{)15908}$	(A) 209 (B) 29 R24 (C) 208 (D) 209 R24 (E) Not given
		g. Involving a 4- or 5-digit dividend and 2-digit divisor	Naming the quotient, given verbal division operation or division operator	12	Divide 15 884 by 76. (or 15 884 ÷ 76) (A) 209 (B) 29 R24 (C) 208 (D) 209 R24 (E) Not given	

1.3 ***Skill Area:*** Addition-Subtraction of Rational Numbers

1.31	Determine the sum of two or more rational numbers in fraction form.	a. Involving two numbers less than 1 to sum to less than or equal to 1, or possible reducing in sum	Naming the sum, horizontal or vertical form	6 & 12	$\frac{3}{7} + \frac{2}{7}$	(A) $\frac{5}{28}$ (B) $\frac{5}{7}$ (C) $\frac{6}{7}$ (D) $\frac{6}{28}$ (E) Not given
					$\frac{3}{8} + \frac{1}{2}$	(A) $\frac{7}{8}$ (B) $\frac{5}{8}$ (C) $\frac{5}{16}$ (D) $\frac{3}{16}$ (E) Not given
		b. Involving two numbers less than 1 to sum to less than or equal to 1, renaming in addition	Naming the sum, horizontal or vertical form	6 & 12	$\frac{1}{6} + \frac{5}{8}$	(A) $\frac{19}{24}$ (B) $\frac{23}{24}$ (C) $\frac{21}{48}$ (D) $\frac{33}{48}$ (E) Not given
		c. Involving one or more numbers in mixed numeral form involving:				
		i) no renaming in addition	Naming the sum, horizontal or vertical form	6 & 12	$2\frac{1}{4} + 1\frac{3}{8}$	(A) $3\frac{1}{2}$ (B) $3\frac{5}{8}$ (C) 4 (D) $3\frac{7}{8}$ (E) Not given
		ii)renaming in addition	Naming the sum, horizontal or vertical form	6 & 12	$3\frac{2}{3} + 5\frac{4}{7}$	(A) $8\frac{20}{21}$ (B) $9\frac{5}{21}$ (C) $8\frac{6}{7}$ (D) $9\frac{1}{7}$ (E) Not given

17

1.3 ***Skill Area:*** Addition-Subtraction of Rational Numbers (Cont.)

1.31 (Cont.)	Determine the sum of two or more rational numbers in fraction form.	d. Involving 2 or 3 numbers less than 1, different denominators to sum to: i) less than 1	Naming the sum	6 & 12	$\frac{1}{3} + \frac{1}{2} + \frac{1}{12}$ (A) $\frac{11}{12}$ (B) 1 (C) $1\frac{1}{12}$ (D) $\frac{35}{36}$ (E) Not given
		ii) greater than 1	Naming the sum in mixed numeral form	6 & 12	$\frac{1}{2} + \frac{5}{8} + \frac{1}{4}$ (A) $1\frac{1}{8}$ (B) $\frac{9}{8}$ (C) $\frac{7}{8}$ (D) $\frac{1}{8}$ (E) Not given
		e. Involving two or three numbers in mixed numerals and/or integers	Naming the sum	12	$2\frac{1}{4} + 1\frac{3}{8} + 5$ (A) $8\frac{1}{2}$ (B) 9 (C) $8\frac{5}{8}$ (D) $3\frac{5}{8}$ (E) Not given
		f. Involving two or three numbers in mixed numerals, different denominators	Naming the sum given verbal sum operation	12	Find the sum of: $5\frac{1}{4}$, $4\frac{3}{8}$, and $8\frac{11}{16}$ (A) $17\frac{15}{16}$ (B) $18\frac{15}{16}$ (C) $17\frac{5}{8}$ (D) $18\frac{1}{16}$ (E) Not given
1.32	Determine the difference of two rational numbers in fraction form.	a. Involving numbers less than 1: i) same denominators	Naming the difference, horizontal or vertical form	6 & 12	$\frac{3}{7} - \frac{1}{7}$ (A) $\frac{4}{7}$ (B) $\frac{2}{7}$ (C) $\frac{1}{7}$ (D) $\frac{11}{7}$ (E) Not given
		ii) one denominator multiple of the other	Naming the difference	6 & 12	$\frac{2}{5} - \frac{3}{10}$ (A) $\frac{1}{10}$ (B) $\frac{5}{10}$ (C) $\frac{1}{5}$ (D) 1 (E) Not given
		iii) denominators not multiples	Naming the difference	6 & 12	$\frac{3}{4} - \frac{2}{5}$ (A) $\frac{1}{5}$ (B) $\frac{7}{20}$ (C) $\frac{1}{20}$ (D) $\frac{6}{20}$ (E) Not given
		b. Involving a mixed fraction sum and the addend less than 1			
		i) same denominators, no renaming of mixed fraction	Naming the difference	6 & 12	$1\frac{4}{5} - \frac{3}{5}$ (A) $\frac{4}{5}$ (B) $\frac{8}{5}$ (C) $\frac{1}{5}$ (D) $\frac{6}{5}$
		ii) same denominators, renaming mixed fraction	Naming the difference	6 & 12	$4\frac{3}{8} - \frac{5}{8}$ (A) $\frac{15}{4}$ (B) $\frac{3}{8}$ (C) $\frac{6}{8}$ (D) $\frac{11}{8}$ (E) Not given
		c. Involving a whole number sum and a rational or mixed fraction addend, renaming the sum	Naming the difference	6 & 12	$6 - 3\frac{2}{7}$ (A) $3\frac{4}{7}$ (B) $9\frac{4}{7}$ (C) $\frac{12}{7}$ (D) $\frac{11}{7}$ (E) Not given
		d. Involving mixed fractions, renaming the sum and addend	Naming the difference	6 & 12	$3\frac{2}{5} - 1\frac{1}{2}$ (A) $1\frac{9}{10}$ (B) $2\frac{1}{10}$ (C) $1\frac{1}{5}$ (D) $2\frac{1}{5}$ (E) Not given
		e. Involving mixed numerals and integers	Naming the difference	6 & 12	$6 - 3\frac{3}{7}$ (A) $3\frac{4}{7}$ (B) $3\frac{3}{7}$ (C) $4\frac{3}{7}$ (D) $2\frac{4}{7}$ (E) Not given

1.4 ***Skill Area:*** Multiplication and Division of Rational Numbers

1.41	Determine the product of two rational numbers in fraction form.	a. Involving two factors each less than 1, no "cancellation"	Naming the product, horizontal or vertical form	6 & 12	$\frac{4}{5} \times \frac{2}{3}$	(A) $\frac{6}{8}$ (B) $\frac{8}{15}$ (C) $\frac{6}{15}$ (D) $\frac{22}{15}$ (E) Not given
		b. Involving two factors, "cancellation"	Naming the product, horizontal or vertical form	6 & 12	$\frac{3}{4} \times \frac{8}{9}$	(A) $\frac{2}{3}$ (B) $\frac{6}{36}$ (C) $\frac{8}{12}$ (D) $\frac{12}{9}$ (E) Not given
		c. Involving a factor less than one, and a whole number factor	Naming the product, horizontal or vertical form	6 & 12	$\frac{7}{9} \times 14$	(A) $\frac{21}{9}$ (B) $\frac{98}{126}$ (C) $\frac{98}{9}$ (D) $\frac{7}{126}$ (E) Not given
		d. Involving a factor in mixed numeral form and a whole number or proper fraction or fraction in mixed numeral form	Naming the product, horizontal or vertical form	6 & 12	$2\frac{1}{2} \times 3$	(A) $\frac{3}{2}$ (B) $2\frac{3}{10}$ (C) $2\frac{4}{7}$ (D) $\frac{6}{10}$ (E) Not given
		e. Involving three numbers, two being fractional and the third in mixed numeral form	Naming the product, given verbal multiplication operation	12	Find the product of $2\frac{1}{3}$, $\frac{5}{14}$, and $\frac{9}{10}$.	(A) $2\frac{3}{28}$ (B) $2\frac{15}{27}$ (C) $\frac{1}{2}$ (D) $\frac{3}{4}$ (E) Not given
1.42	Determine the quotient in division of two rational numbers in fraction form.	a. Involving proper fractions, the divisor and dividend having same denominator	Naming the missing factor	6 & 12	$\frac{5}{8} \div \frac{1}{8}$	(A) $\frac{1}{5}$ (B) $\frac{5}{64}$ (C) 5 (D) $\frac{5}{16}$ (E) Not given
		b. Involving proper fractions, having dissimilar denominator: i) no "reduction"	Naming the missing factor in fraction form	6 & 12	$\frac{2}{3} \div \frac{5}{7}$	(A) $\frac{10}{21}$ (B) $\frac{9}{8}$ (C) $\frac{14}{15}$ (D) $\frac{7}{10}$ (E) Not given
		ii) "reduction"	Naming the missing factor in fraction form	6 & 12	$\frac{6}{8} \div \frac{4}{5}$	(A) $\frac{16}{15}$ (B) $\frac{15}{16}$ (C) $\frac{3}{5}$ (D) $\frac{5}{3}$ (E) Not given
		c. Involving mixed fractions, dissimilar denominators	Naming the missing factor in mixed numeral form	6 & 12	$2\frac{1}{3} \div 2\frac{1}{5}$	(A) $3\frac{1}{3}$ (B) $16\frac{2}{15}$ (C) $14\frac{1}{15}$ (D) $3\frac{1}{30}$ (E) Not given
		d. Involving a whole number dividend and a number in proper fraction or mixed numeral form as divisor	Naming the missing factor	6 & 12	$12 \div \frac{3}{4}$	(A) 9 (B) 16 (C) $4\frac{3}{4}$ (D) $5\frac{1}{3}$ (E) Not given

1.4 ***Skill Area:*** Multiplication and Division of Rational Numbers (Cont.)

1.42 (Cont.)	Determine the quotient in division of two rational numbers in fraction form.	e. Involving a number in fraction form as dividend and a whole number as divisor	Naming the missing factor	6	$\frac{1}{2} \div 6$ (A) 3 (B) $\frac{1}{12}$ (C) $\frac{1}{3}$ (D) 12 (E) Not given
		f. Involving numbers less than 1	Naming the quotient for a fraction of two fractions	12	$\frac{\frac{3}{8}}{\frac{9}{16}}$ (A) $\frac{2}{3}$ (B) $\frac{27}{128}$ (C) $1\frac{2}{17}$ (D) $\frac{11}{24}$ (E) Not given
1.43	Determine the sum of two or more rational numbers in decimal form.	a. Involving 1- or 2-digit numerals with one or two decimal places in each	Naming the sum, horizontal or vertical form	6	1.3 +2.5 (A) 1.8 (B) 1.2 (C) 3.8 (D) 3.2 (E) Not given
		b. Involving 3-digit numerals with 2 decimal places, renaming	Naming the sum, horizontal or vertical form	6 & 12	7.58 + 6.46 (A) 14.04 (B) 20.04 (C) 13.94 (D) 1.12 (E) Not given
		c. Involving three numbers up to 3-digits and up to 2 decimal places	Naming the sum, horizontal or vertical form	12	1.05 + 0.75 + 21.5 (A) 23.30 (B) 22.30 (C) 23.20 (D) 22.40 (E) Not given
		d. Involving two numbers	Naming the sum, horizontal or vertical form	6 & 12	12.7 + 183 (A) 31.0 (B) 195.7 (C) 19.57 (D) 1 957.0 (E) Not given
		e. Involving three numbers up to 3-digit rational number with various place value and 1- or 2-digit integer	Naming the sum, horizontal or vertical form	6 & 12	0.663 + 5.58 + 7 (A) 1.228 (B) 13.143 (C) 13.243 (D) 12.243 (E) Not given
		f. Involving up to five numbers, with up to 6-digits	Naming the sum, horizontal or vertical form	6 & 12	21.42 139.79 4.08 + 359.70 (A) 2 324.89 (B) 2 524.99 (C) 2 523.99 (D) 2 523.89 (E) Not given
1.44	Determine the difference of two rational numbers in decimal form.	a. Involving a 3-digit 2 decimal place minuend (sum) and subtrahend (addend), no renaming	Naming the difference, horizontal or vertical form	6 & 12	3.98 -2.45 (A) 1.54 (B) 1.43 (C) 1.53 (D) 1.44 (E) Not given
		b. Involving up to 3-digit one decimal place sum and up to 2-digit one decimal place, addend renaming	Naming the difference, horizontal or vertical form	6	62.3 - 4.9 (A) 62.6 (B) 67.2 (C) 58.4 (D) 57.4 (E) Not given
		c. Involving up to 3 decimal place sum and addend	Naming the difference, horizontal or vertical form	6 & 12	437.003 - 23.260 (A) 414.743 (B) 414.263 (C) 413.743 (D) 413.263 (E) Not given
		d. Involving integer sum, the addend having up to 3 decimal place	Naming the difference, horizontal form	12	6 - 2.573 (A) 3.437 (B) 5.427 (C) 4.527 (D) 3.427 (E) Not given
		e. Involving numbers up to 5-digits having significant zeros	Naming the difference, the difference operation given in verbal form	6 & 12	Find the difference between: 1.0005 and 0.0326 (A) 0.9689 (B) 0.9679 (C) 1.9689 (D) 1.9679 (E) Not given

1.4 ***Skill Area:*** Multiplication and Division of Rational Numbers (Cont.)

1.45	Determine the product of two rational numbers in decimal form.	a. Involving proper fraction, 1 decimal place	Naming the product, horizontal or vertical form	6 & 12	0.7 x 0.8	(A) 0.32 (B) 3.2 (C) 1.5 (D) 0.15 (E) Not given
		b. Involving proper fractions, 2 decimal places	Naming the product, horizontal or vertical form	6 & 12	0.15 x 0.45	(A) 6.75 (B) 0.675 (C) 0.0675 (D) 67.5 (E) Not given
		c. Involving a proper fraction with 1 decimal place and a 2-digit numeral with 1 decimal place	Naming the product, horizontal or vertical form	6	0.6 x 1.4	(A) 0.84 (B) 8.4 (C) 0.64 (D) 6.4 (E) Not given
		d. Involving proper fractions, with "0" in tenths and/or hundredths place	Naming the product	6	0.006 x 0.08	(A) 4.8 (B) 0.48 (C) 0.048 (D) 0.00048 (E) Not given
		e. Involving a number with up to 2 decimal places and a number with 1 decimal place	Naming the product, vertical form	6 & 12	12.80 x 1.5	(A) 1.920 (B) 19.20 (C) 1.920 (D) 192.00 (E) Not given
		f. Involving a decimal and a whole number	Naming the product, horizontal or vertical form	6 & 12	1.44 x 4	(A) 5.68 (B) 4.76 (C) 1.48 (D) 5.76 (E) Not given
			Naming the product for verbal product operation		Find the product of 37.98 and 0.375	(A) 142.4250 (B) 13.2425 (C) 14.2325 (D) 14.2425 (E) Not given
1.46	Determine the quotient in division of two rational numbers in decimal form.	a. Involving less than 100 with up to 2 decimal places as dividend and a whole number as divisor	Naming the quotient, horizontal or ratio form	6 & 12	48.4 ÷ 2	(A) 24.2 (B) 2.42 (C) 242 (D) 0.242 (E) Not given
		b. Involving two numbers up to 3 decimal places	Naming the quotient, horizontal or standard form	6 & 12	1.008 ÷ 0.09	(A) 0.112 (B) 1.12 (C) 11.2 (D) 112 (E) Not given
					$2.1\overline{)9.03}$	(A) 416.3 (B) 41.63 (C) 4 163 (D) 316.3 (E) Not given
		c. Involving a whole number dividend and a proper fraction as divisor	Naming the quotient, standard form	6 & 12	$0.12\overline{)36}$	(A) 3 (B) 300 (C) 30 (D) 0.3 (E) Not given
		d. Involving a number less than 100 with up to 3 decimal place dividend and a whole number greater than 10 divisor	Naming the quotient, standard form	6 & 12	$253\overline{)53.1}$	(A) 0.209 (B) 0.298 (C) 0.210 (D) 0.219 (E) Not given

21

1.5 ***Skill Area:*** **Conversion of Rational Numbers from One Form to the Other**

1.51	Express a rational number in decimal or fraction form as a percent.	a. Involving a rational number in fraction form: i) numerator 1 and denominator multiple of 10	Naming the percent	6 & 12	What is the percent form of $\frac{1}{20}$? (A) 20% (B) 50% (C) 5% (D) 2% (E) Not given
		ii) numerator 1 and denominator a number less thar 10	Naming the percent	6 & 12	What is the percent form of the fraction $\frac{1}{8}$? (A) 8% (B) 80% (C) 12.5% (D) 1.25% (E) Not given
		b. Involving a rational number in decimal form with: i) a 2-digit fraction part	Naming the percent	6 & 12	What is the percent form of 0.26? (A) 2.6% (B) 26% (C) 0.26% (D) 260% (E) Not given
		ii) a 3-digit fraction part	Naming the percent	6 & 12	What is percent form of 0.103? (A) 103% (B) 10.3% (C) 0.103% (D) 1.03% (E) Not given
		iii) a 1-digit whole and 1-digit fraction part	Naming the percent	6	What is percent form for 1.1? (A) 11% (B) 110% (C) 1.1% (D) 0.11% (E) Not given
1.52	Express a rational number in fraction or percent form in percent or decimal form.	a. Involving a rational number in percent form with: i) a 2-digit integer	Naming the decimal form	6 & 12	25% written as decimal is: (A) 0.25 (B) 2.5 (C) 0.025 (D) 25.0 (E) Not given
		ii) a 3-digit integer	Naming the decimal form	6 & 12	350% written as decimal is: (A) 350.0 (B) 3.50 (C) 35.0 (D) 0.35 (E) Not given
		iii) mixed numerals	Naming the decimal form	6 & 12	$3\frac{1}{2}$% written as decimal is: (A) 3.5 (B) 3.2 (C) 35 (D) 0.35 (E) 0.035
		b. Involving a rational number in fraction form with: i) denominator a multiple of 10 or 100	Naming the percent form	6 & 12	$\frac{9}{100}$ expressed as a percent is: (A) 0.9 (B) 0.09 (C) 9% (D) 90% (E) Not given
		ii) denominator as multiple of 10	Naming the percent form	6 & 12	$\frac{3}{20}$ expressed as a percent is: (A) 15% (B) 0.15% (C) 1.5% (D) $\frac{3}{2}$ (E) Not given

1.5 ***Skill Area:*** Conversion of Rational Numbers from One Form to the Other (Cont.)

1.53	Express a rational number in percent or decimal form in lowest term fractions.	a. Involving a rational number in percent form with: i) a 2-digit integer	Naming the fraction	6 & 12	75% written as a fraction in lowest terms is: (A) $\frac{3}{5}$ (B) $\frac{4}{5}$ (C) $\frac{3}{4}$ (D) $\frac{2}{3}$ (E) Not given
		ii) a 3-digit integer	Naming the fraction	6 & 12	150% written as a mixed numeral in lowest terms is: (A) $10\frac{1}{2}$ (B) $1\frac{1}{20}$ (C) $15\frac{1}{2}$ (D) $1\frac{1}{2}$ (E) Not given
		b. Involving a rational number in decimal form with: i) 1-digit fraction part only	Naming the fraction	6 & 12	0.5 written as a fraction in lowest terms is: (A) $\frac{3}{5}$ (B) $\frac{4}{5}$ (C) $\frac{3}{4}$ (D) $\frac{2}{3}$ (E) Not given
		ii) a 1-digit whole and up to 3-digit fraction parts	Naming the fraction	6 & 12	1.25 written as a fraction in lowest terms is: (A) $\frac{3}{5}$ (B) $\frac{4}{5}$ (C) $\frac{3}{4}$ (D) $\frac{2}{3}$ (E) Not given
		iii) a repeating digit fraction part	Naming the fraction	12	$.\overline{45}$ written as a fraction in lowest terms is: (A) $\frac{5}{11}$ (B) $\frac{5}{9}$ (C) $\frac{3}{4}$ (D) $\frac{5}{12}$ (E) Not given

23

2.0 SUBCONTENT AREA: ARITHMETIC COMPREHENSION

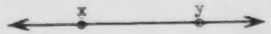
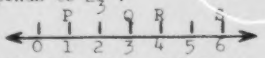
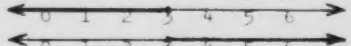
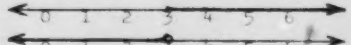
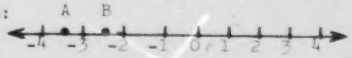
2.1 *Skill Area:* Numbers and Numerals

Level	*Subskill Area*	*Illustrative Item Specification*		*Grade Level*	*Example*
		Subskill	*Performance Mode*		
2.11	Identify a numeral given its word name or equivalent name.	a. Involving whole number	Choosing the numeral for given word name or vice versa	6 & 12	Which numeral names three hundred three? (A) 3 003 (B) 330 (C) 303 (D) 33
		b. Involving whole number and equivalent rational number in fraction form	Choosing the numeral which names a whole number	6	Which of these numerals names a whole number? (A) $\frac{25}{4}$ (B) $\frac{26}{5}$ (C) $\frac{27}{6}$ (D) $\frac{28}{7}$
		c. Involving whole number and composite of two rational numbers in fraction form	Choosing the numeral for the sum of two fraction numbers	6	Which of these numerals is another name for 1? (A) $\frac{1}{2}+\frac{1}{2}$ (B) $\frac{1}{3}+\frac{1}{4}$ (C) $\frac{1}{3}+\frac{1}{3}$ (D) $\frac{1}{2}+\frac{1}{3}$
		d. Involving rational number in fraction form	Choosing an equivalent name for given fraction numbers	6 & 12	Which of these numerals is another name for $\frac{1}{2}$? (A) $\frac{4}{8}$ (B) 3 (C) $\frac{2}{3}$ (D) $\frac{5}{15}$
		e. Involving a decimal number with integer and tenths or hundredths part	Choosing the numeral	12	A decimal numeral for 5 and 3 tenths is: (A) 0.53 (B) 5.3 (C) 53.0 (D) 0.053 (E) Not given
		f. Involving some integer and some thousandths	Choosing the numeral	12	A decimal numeral for twenty-nine and three hundred thirty-two thousandths is: (A) 29.332 (B) 29.0332 (C) 293.320 (D) 29.00332 (E) Not given
		g. Involving a proper decimal fraction in ten-thousandths	Choosing the numeral	12	A decimal numeral for twenty-one ten-thousandths is: (A) .021 (B) .21 (C) .0021 (D) .00021 (E) Not given
		h. Involving rational number in decimal form	Choosing an equivalent name for given rational number	6 & 12	Which of these numerals name the same number as 0.0503? (A) 503 thousandths (B) $\frac{503}{10\ 000}$ (C) 503 000 (D) $\frac{503}{1\ 000}$

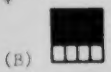
2.1 ***Skill Area:*** Numbers and Numerals (Cont.)

2.11 (Cont.)	Identify a numeral given its word name or equivalent name.	i. Involving rational numbers in fraction, decimal, or percent form	Choosing the one which does not belong	12	Four of these numerals name the same number. Which one names a different number? (A) 0.025 (B) 25% of 0.1 (C) $\frac{1}{40}$ (D) $\frac{25}{100}$ (E) $\frac{75}{3\,000}$
2.12	Identify place value of given numeral(s) or vice versa.	a. Involving whole numbers	Choosing the numeral when the face value and place value of a digit are given	6 & 12	Which of these numerals has a 9 in the thousands place? (A) 6 790 (B) 5 409 (C) 9 005 (D) 7 905
			Choosing the numeral when the actual and face value of a digit is given	6 & 12	In which numeral does 6 name sixty thousand? (A) 460 327 (B) 601 372 (C) 203 167 (D) 896 237
2.13	Identify place value of given numerals.	a. Involving whole numbers	Choosing the numeral when actual values of several digits are given	6 & 12	Which numeral names 5 thousands, 4 tens, and 6 ones? (A) 546 (B) 5 046 (C) 5 406 (D) 50 406
			Choosing the numeral for expanded notation for writing whole numbers and vice versa	6 & 12	3 000 + 200 + 8 names the same number as: (A) 32 840 (B) 30 284 (C) 3 281 (D) 3 284 (E) Not given
		b. Involving rational number in decimal form	Choosing the numeral for expanded notation for writing decimal numbers	12	$5\cdot(10^2) + 7\cdot(10^1) + 3\cdot(\frac{1}{10}) + 2\cdot(\frac{1}{10^2})$ written in decimal form is: (A) 57.32 (B) 57.032 (C) 570.32 (D) 573.2 (E) Not given
2.14	Round off given number.	a. a 3-digit number to nearest hundred	Choosing the numeral	6 & 12	Round off 495 to the nearest hundred. (A) 490 (B) 400 (C) 500 (D) 595 (E) Not given
		b. An integer with more than 3 digits to fewer digits	Choosing the numeral	12	Round off 77 564 497 to the nearest hundred thousand. (A) 77 600 000 (B) 77 560 000 (C) 78 000 000 (D) 77 500 000 (E) Not given
		c. A rational number in decimal form with 5-digit fractional part to fewer digits	Choosing the numeral	12	Round off 8.23456 to the nearest thousandth. (A) 8.234 (B) 8.235 (C) 8.2345 (D) 8.2346 (E) Not given Approximate 743.29999 to three decimal places. (A) 700 (B) 743 (C) 743.200 (D) 743.300 (E) Not given

2.1 ***Skill Area:*** Numbers and Numerals (Cont.)

2.15	Recognize order relationship among numbers.	a. Involving several rational numbers in fraction form	Arranging numbers in decreasing order and choosing the ordinal number for the specified quantity	6 & 12	Here are some numbers named by fractions: $\frac{3}{8}$, $\frac{1}{2}$, $\frac{2}{5}$, $\frac{1}{6}$. If you arrange them in order, from greatest to least, where would $\frac{2}{5}$ be? (A) First (B) Second (C) Third (D) Fourth
			Arranging numbers in decreasing order and choosing the greatest	6 & 12	Here are some numbers named by fractions: $\frac{3}{4}$, $\frac{2}{5}$, $\frac{7}{8}$, $\frac{1}{3}$. Which names the greatest number? (A) $\frac{7}{8}$ (B) $\frac{1}{3}$ (C) $\frac{3}{4}$ (D) $\frac{2}{5}$
			Choosing the set of numbers which are arranged in decreasing order	6 & 12	Which list of fractions is in order from greatest to least? (A) $\frac{1}{2}, \frac{1}{4}, \frac{1}{3}$ (B) $\frac{1}{3}, \frac{1}{4}, \frac{1}{2}$ (C) $\frac{1}{4}, \frac{1}{3}, \frac{1}{2}$ (D) $\frac{1}{3}, \frac{1}{2}, \frac{1}{4}$ (E) $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$
2.16	Recognize relationship among points on a number line.	a. A number line which is marked by monomials	Providing or choosing relational symbol	6 & 12	If two numbers x and y have positions as shown on the number line, then:  (A) $x=y$ (B) $x<y$ (C) $x>y$ (D) We cannot tell since the values of x and y are not known. (E) Not given
		b. A number line marked by negative and/or positive integers	Choosing the points which correspond to a rational number	6 & 12	On this number line, where is the point which corresponds to $2\frac{1}{3}$?  (A) To the left of P (B) To the right of S (C) Between P & Q (D) Between R & Q
		c. Relationship of points on number line	Choosing from several marked number lines the one which represents a given mathematical sentence	12	Which number line represents the set of solutions of the sentence $x < 3$? (A) (B) (C)  (D)  (E)
		d. A number line marked by negative and positive integers	Choosing the mathematical sentence representing relationship between two non-coincident points	12	Given:  Which of these statements about A and B is true? (A) $A=B$ (B) $B<A$ (C) $A \geq B$ (D) $A \neq B$ (E) $B>A$

2.1 ***Skill Area:*** Numbers and Numerals (Cont.)

2.17	Express repeated multiplication in exponential form or vice versa.	a. Involving whole number and positive exponents	Expressing from exponent form to a repeated multiplication form	12	6^3 means the same as: (A) 6+6+6 (B) 6x3 (C) 3^6 (D) 6x6x6
			Naming the number for given exponent form	12	2^5 equals: (A) 10 (B) 16 (C) 25 (D) 32
		b. Involving whole numbers and negative exponents	Naming the number for given exponent form	12	7^{-2} equals: (A) -14 (B) 49 (C) $\frac{1}{49}$ (D) $\frac{1}{14}$
		c. Involving product of two exponentiated numbers	Naming the correct number	12	$3^2 \times 3^5$ equals: (A) 3^7 (B) 3^{10} (C) 15 (D) 30
2.18	Express a number in scientific notation, i.e., the product of a number and a power of 10.	a. A whole number expressed as a product of whole number and positive power of 10	Choosing the correct numeral	12	97 300 means the same as: (A) 973 x 10^{12} (B) 97.3 x 10^2 (C) 9.73 x 10^2 (D) 9.73 x 10^3
		b. A whole number expressed as a product of decimal number and positive power of 10	Choosing the correct numeral	12	4 106 000 written as the product of a decimal number between 1 and 10 and a power of 10 is: (A) 4 106 x 10^3 (B) 4.106 x 10^3 (C) 4.106 x 10^6 (D) 4 106 x 10^5
		c. A rational number in decimal form expressed as a product of whole number and negative power of 10	Choosing the correct numeral	12	0.0025 means the same as: (A) 25 x 10^{-1} (B) 25 x 10^{-2} (C) 25 x 10^{-3} (D) 25 x 10^{-4}
		d. A rational number in decimal form expressed as a product of decimal number and negative power of 10	Choosing the correct numeral	12	0.924 written as the product of a decimal number between 1 and 10 and a power of 10 is: (A) 9.24 x 10^{-1} (B) 9.24 x 10^{-2} (C) 924 x 10^{-3} (D) 9.24 x 10^{-3}
2.19	Identify rational numbers in fractional form.	a. Involving geometric objects	Identifying the subset of objects which represent a given fraction	6 & 12	Which of the following has $\frac{2}{3}$ of its circles shaded? (A) ● ○ ○ (B) ● ● ● (C) ● ○ ● (D) ○ ○ ○
			Identifying part of a geometric shape which represents a given fraction	6 & 12	Which figure is $\frac{3}{4}$ shaded? (A) (B)  (C)
			Identifying the fraction which represents a subset of objects	6 & 12	What part of this diagram is shaded? △ △ ▲ △ △ ▲ △ △ (A) $\frac{1}{8}$ (B) $\frac{1}{4}$ (C) $\frac{2}{4}$ (D) $\frac{3}{4}$
2.110	Identify equivalent rational numbers in decimal and fraction forms.	a. Involving proper fractions	Naming the equivalent fraction	6 & 12	Which of the following is the same as $\frac{3}{4}$? (A) 3.4 (B) 4.3 (C) 0.75 (D) 0.68 (E) Not given

2.2 ***Skill Area:*** Properties of Operators

2.21	Identify commutative property.	a. In addition, equation involving whole or rational numbers	Naming the missing numeral to make the equation true	6 & 12	Select the correct name for the missing number to make this statement a true statement: $2.45 + 4.27 = 4.27 + \square$ (A) 1.82 (B) 2.45 (C) 4.27 (D) 10.29 **(E) Not given**
		b. In multiplication, equation involving whole numbers	Naming the missing numeral to make the equation true	6 & 12	Select the correct name for the missing number to make this statement a true statement: $6 \times 5 = \square \times 6$ (A) 9 (B) 90 (C) 15 (D) 540 (E) Not given
2.22	Identify associative property.	a. In equations involving whole numbers	Naming the missing numeral to make the equation true	6 & 12	Select the correct name for the missing number to make this statement a true statement: $(70 + 30) + 50 = 70 + (\square + 50)$ (A) 20 (B) 30 (C) 50 (D) 70 (E) Not given
		b. In equations involving rational number in fraction form	Naming the missing numeral to make the equation true	6 & 12	Select the correct name for the missing number to make this statement a true statement: $(\frac{1}{2} + \frac{1}{4}) + \frac{3}{4} = \frac{1}{2} + (\square + \frac{1}{4})$ (A) $\frac{1}{4}$ (B) $\frac{1}{2}$ (C) $\frac{3}{4}$ (D) $1\frac{1}{4}$ (E) Not given
		c. In equations involving negative numbers	Naming the missing numeral to make the equation true	12	Select the correct name of the missing number to make this equation true: $(-2) + (\square + (-5)) = ((-2) + 6) + (-5)$: (A) -5 (B) 6 (C) -6 (D) 1 (E) Not given
2.23	Identify distributive property.	a. In equations involving whole numbers	Naming the missing numeral to make the equation true	6 & 12	Select the correct name for the missing number to make this statement true: $3 \cdot 26 = (3 \cdot \square) + (3 \cdot 6)$: (A) 2 (B) 6 (C) 20 (D) 26 (E) Not given
		b. In equations involving negative numbers	Naming the missing numeral to make the equation true	12	Select the correct name of the missing number to make this statement true: $(67) \cdot (19) + (67 \cdot \square) = (67) \cdot (10)$: (A) 0 (B) 1 (C) -1 (D) -9 (E) Not given
2.24	Identify identity and inverse elements.	a. Identifying element in equations involving whole numbers	Choosing the missing numeral to make the statement true	12	Select the correct name for the missing number to make this statement true: $(64 \times \square) \div 16 = 64$ (A) 0 (B) 4 (C) 16 (D) 64 (E) Not given

2.2 ***Skill Area:*** Properties of Operators (Cont.)

2.24 (Cont.)	Identify and inverse elements.	b. Inverse elements in addition equations: i) involving whole numbers	Choosing the missing numeral to make the statement true	12	Select the correct name of the missing number to make this statement a true statement: $(-5) + \square = 0$ (A) 0 (B) -5 (C) 5 (D) 1 (E) Not given
		ii) involving fractions	Choosing the missing numeral to make the statement true	6 & 12	Select the correct name for the missing number to make the following statement true: $(2 - \square) + \frac{1}{10} = 2$ (A) $\frac{1}{2}$ (B) $\frac{3}{10}$ (C) $\frac{9}{10}$ (D) $1\frac{9}{10}$ (E) Not given
		c. Inverse elements in multiplication equations	Choosing the missing numeral to make the statement true	12	Select the correct name of the missing number to make the following statement true: $(-19 + \square) = 1$ (A) -1 (B) 0 (C) 18 (D) $-\frac{1}{19}$ (E) Not given
2.25	Identify property of zero.	a. In addition, subtraction, multiplication, or division equation	Choosing the missing numeral	12	Select the name for the missing number to make the following statement true: $4 \times \square = 0$ (A) 1 (B) 4 (C) $\frac{1}{4}$ (D) 0 (E) Not given
2.26	Identify mathematical symbols $=, \neq, <, >$, or phrases "is equal to," "is not equal to," "is less than," and "is greater than."	a. Involving two additive expressions with whole numbers	Providing or choosing the symbol	6 & 12	Select the correct symbol ($=, \neq, <, >$) to make this statement a true statement: $2 + 6 \bigcirc 4 + 5$ (A) = (B) < (C) > (D) $\neq$
		b. Involving two multiplicative expressions with whole numbers	Providing or choosing the symbol	6 & 12	Select the correct symbol ($=, <, >$) to make this statement a true statement: $25 \times 10 \bigcirc 24 \times 11$ (A) = (B) < (C) > (D) Not given
		c. Involving two mathematical sentences with fractions	Providing or choosing the verb form	6 & 12	Select the correct phrase ("is equal to," "is less than," "is greater than") to make this statement a true statement: $(5 \times \frac{1}{3}) \bigcirc (5 \times \frac{1}{2})$ (A) "is equal to" (B) "is less than" (C) "is greater than" (D) Not given
		d. Involving a mathematical expression	Providing or choosing the symbol	6 & 12	Which of the following signs in the expression $3 \square 5$ will make it a negative whole number? (A) x (B) $\div$ (C) - (D) >

2.2 ***Skill Area:*** Properties of Operators (Cont.)

2.26 (Cont.)	Identify mathematical symbols =, <, ≠, >, or phrases "is equal to," "is less than," "is not equal to," and "is greater than."	e. Involving two mathematical expressions	Providing or choosing the verb form	6 & 12	Select the correct phrase ("is equal to," "is less than," "is greater than") to make this statement a true statement: $9 \times \frac{1}{9} \bigcirc \frac{3}{4}$ (A) "is equal to" (B) "is less than" (C) "is greater than" (D) Not given
				6 & 12	Select the correct phrase ("is equal to," "is less than," "is not equal to") to make this statement a true statement: $3 \times \frac{1}{4} \bigcirc 4 \times \frac{1}{8}$ (A) "is equal to" (B) "is less than" (C) "is not equal to" (D) Not given

2.3 ***Skill Area:*** Number Theory

2.31	Recognize odd and even numbers.	a. Involving a set of odd or even numbers	Choosing the set which represents odd or even numbers	6 & 12	Which of these sets contains <u>only</u> even number? (A) {4,9,16,25,36} (B){5,10,15,20,25} (C) {20,22,24,26,28} (D) {41,43,45,47,49}
		b. In an arithmetical expression of odd or even numbers	Naming the odd/even expression	6 & 12	Which of these names an odd number? (A) 17 x 28 (B) 91 + 118 (C) 186 x 142 (D) 93 - 47
		c. In an arithmetical or algebraic expression of odd or even numbers	Naming a number which when added to or subtracted from an odd/even number produces odd/even number	6 & 12	Suppose you start with an odd number. Which of these can be added to it to produce an even number? (A) 0 (B) 3 (C) 4 (D) 10
2.32	Identify prime and composite numbers.	a. Involving a single or a set of prime numbers	Naming the number	6 & 12	Which is a prime number? (A) 21 (B) 13 (C) 91 (D) 49 (E) 111
			Choosing prime factors	12	Which set contains only primes? (A) {1,2,3,4,5} (B) 2,4,6,8,10} (C) {2,5,6,11,13} (D) 0,9,15,21,27} (E) Not given
		b. Involving a set of composite numbers	Choosing the set	12	Which set contains only composite numbers? (A) {2,4,6,8,10} (B) {2,5,7,11,13} (C) {1,2,3,4,5,} (D) {0,9,15,21,27} (E) Not given
2.33	Identify expressions of positive or negative numbers.	a. Involving whole numbers	Providing the missing operator to make the expression positive negative whole number	6	$3 \square 2$ Which of the following signs will make the above expression a positive whole number? **(A) X (B) - (C) = (D) Not given**

2.3 ***Skill Area:*** Number Theory (Cont.)

2.34	Recognize prime factors of a number.	a. Involving factors of a number 150 or less	Choosing the factors which are prime for a given number	6 & 12	The prime factors of 12 are: (A) 3 and 4 (B) 2 and 3 (C) 1 and 12 (D) 6 and 2
			Choosing factorizations that are prime	6 & 12	Which of these factorizations is a prime factorization? (A) 16 = 2x2x4 (B) 20 = 2x2x5 (C) 18 = 2x9 (D)105 = 5x21
			Choosing the least prime factor for a number	6 & 12	The least prime factor of 135 is: (A) 1 (B) 2 (C) 3 (D) 5 (E) Not given
2.35	Identify the divisors of a given number.	a. For a number less than 100, having: i) up to 4 divisors (2 prime factors)	Choosing the correct list	12	All of the divisors of 22 are: (A) 1, 2, 11 (B) 2, 11 (C) 1, 22 (D) 1, 2, 11, 22 (E) Not given
		ii) more than 4 divisors	Choosing the correct list	12	All of the numbers that divide 18 are: (A) 2, 6, 9 (B) 1, 3, 18 (C) 0, 2, 3, 6, 9,18 (D) 1, 2, 3, 6, 9, 18 (E) Not given
		b. For a number greater than 100	Choosing the correct list	12	Select the list of numbers,all of which divide 231. (A) 1, 17 (B) 21, 33 (C) 3, 9 (D) 4, 231 (E) Not given
2.36	Determine the GCF (greatest common factor) of two or three numbers.	a. Two numbers less than 50 with a GCF of 5	Naming the GCF	6 & 12	Find the GCF of 15 and 25. (A) 1 (B) 5 (C) 3 (D) 15 (E) Not given
		b. Two numbers less than 100	Naming the GCF	6 & 12	Find the GCF of 12 and 36. (A) 12 (B) 36 (C) 4 (D) 3 (E) Not given
		c. Three or more numbers	Naming the GCF	6 & 12	Find the GCF of 44, 92, and 124. (A) 2 (B) 23 (C) 11 (D) 4 (E) Not given
		d. Two prime numbers	Naming the GCF	6 & 12	Find the GCF of 23 and 43. (A) 1 (B) 3 (C) 23 (D) 43 (E) Not given
2.37	Determine the LCM (lowest common multiple) of two or three numbers.	a. Two numbers, each less than 10, none being a prime	Naming the LCM	6 & 12	Find the LCM of 4 and 6. (A) 4 (B) 6 (C) 12 (D) 24 (E) Not given
		b. Three numbers, each less than 25	Naming the LCM	6 & 12	Find the LCM of 8, 9, and 12. (A) 8 (B) 9 (C) 12 (D) 72 (E) Not given

2.4 ***Skill Area:*** Arithmetic Operations

2.41	Identify value concepts in addition, subtraction, multiplication, and division algorithms.	a. Involving an addition algorithm in expanded form	Identifying the numerical value associated with certain nominal value	6	Here is an addition problem: $\begin{array}{r} 54 \\ +\ 86 \\ \hline 10 \\ \underline{13} \\ 140 \end{array}$ The 13 is placed where it is to stand for: (A) 10 + 3 (B) 8 + 5 (C) 54 + 86 (D) 50 + 80 (E) 13 hundreds
		b. Involving a multiplication algorithm in expanded form	Identifying the numerical value associated with certain nominal value	6	Here is a multiplication problem: $\begin{array}{r} 458 \\ \times\ 3 \\ \hline 24 \\ 15 \\ \underline{12} \\ 1374 \end{array}$ The 15 stands for: (A) 3 x 5 (B) 5 x 30 (C) 3 x 58 (D) 3 x 50 (E) Not given
		c. Involving a division algorithm in standard form	Identifying the numerical value associated with certain nominal value	6	Here is a division problem: $\begin{array}{r} 42 \\ 8\overline{)336} \\ \underline{320} \\ 16 \\ \underline{16} \\ 0 \end{array}$ The 320 stands for: (A) 4 x 8 (B) 40 x 8 (C) 4 x 80 (D) 42 x 8 (E) Not given
2.42	Solve simple linear equations.	a. Involving addition or subtraction of positive whole numbers	Choosing the mathematical operation required to solve the equation	6 & 12	7 + n = 233 (A) Subtract 7 from 233 (B) Divide 233 by 7 (C) Multiply 233 by 7 (D) Add 7 to 233 (E) Not given
		b. Involving multiplication of positive whole numbers	Choosing the mathematical operation required to solve the equation	6 & 12	23 x 51 = □ (A) Add 23 and 51 (B) Subtract 23 from 51 (C) Multiply 23 and 51 (D) Divide 51 by 23 (E) Not given
		c. Involving division of positive whole numbers	Choosing the mathematical operation required to solve the equation	6 & 12	□ x 46 = 1 244 (A) Add 46 and 1 244 (B) Subtract 46 from 1 244 (C) Multiply 46 and 1 244 (D) Divide 1 244 by 46 (E) Not given
				6 & 12	3 x n = 63 (A) Multiply 63 by 3 (B) Divide 63 by 3 (C) Add 3 to 63 (D) Subtract 3 from 63 (E) Not given
		d. Involving addition or subtraction of two or more positive and negative whole numbers	Naming the numeral	12	(-11) + (-7) = □ (A) 18 (B) 4 (C) -4 (D) -18 (E) Not given
				12	(11) - (-13) = □ (A) -24 (B) 24 (C) -2 (D) 2 (E) Not given

2.4 ***Skill Area:*** Arithmetic Operations (Cont.)

2.42 (Cont.)	Solve simple linear equations.	e. Involving addition or subtraction of two whole numbers; both negative or one positive and one negative numbers	Naming the numeral	12	$(-8) - (-2) = \square$ (A) 10 (B) -10 (C) -6 (D) 6 (E) Not given
				12	$(-13) + 9 + (-6) + 8 = \square$ (A) -2 (B) 2 (C) 18 (D) -18 (E) Not given
		f. Involving multiplication or division of whole numbers; both negative or one positive and one negative numbers	Naming the numeral	12	$(-3) \cdot (9) = \square$ (A) 27 (B) -27 (C) 6 (D) -6 (E) Not given
				12	$56 \div (-8) = \square$ (A) 8 (B) -8 (C) 7 (D) -7 (E) Not given
				12	$(-15)(3) \div (-9) = \square$ (A) 30 (B) -30 (C) 5 (D) -5 (E) Not given
				12	Find the product of: (-6), (-1), and (-3) (A) -36 (B) 36 (C) 32 (D) -32 (E) Not given
2.43	Solve simple quadratic equations.	a. Involving mathematical operation on positive or negative whole numbers	Translating a word description into equation form and solving	12	A mathematical procedure involves squaring the number and then adding 7. If the number is -7, what is the result? (A) 56 (B) 0 (C) 21 (D) 7 (E) Not given

3.0 SUBCONTENT AREA: APPLICATIONS IN ARITHMETIC

3.1 *Skill Area:* Arithmetic Operations of Whole Numbers

Level	*Subskill Area*	*Illustrative Item Specification*		*Grade Level*	*Example*
		Subskill	*Performance Mode*		
3.11	Solve verbal problems related to addition and subtraction.	a. Involving daily life situations	Translating the problem into mathematical equation and finding the solution to the problem	6 & 12	A team scored 12 runs in three baseball games. The players scored 5 runs in the first game and 4 runs in the second game. How many runs did they score in the third game? (A) 3 (B) 9 (C) 12 (D) 21 (E) Not given
				6	An auditorium has 48 rows with 26 seats in each row on the main floor. In the balcony there are 16 rows with 23 seats in each row. What is the largest number of people this auditorium can seat? (A) 49 (B) 113 (C) 1 596 (D) 1 616 (E) Not given
				6	Will's father is 34 years old. His mother is 6 years younger. How old is Will's mother? (A) 27 (B) 28 (C) 40 (D) 42 (E) Not given
				6	A teacher weighed some water in a jar. The scale read 21 ounces. If the jar weighed 4 ounces, how many ounces did the water weigh? (A) 5 (B) 17 (C) 25 (D) 84 (E) Not given
		b. Involving money in daily life situations	Translating the problem into mathematical equation and finding the solution to the problem	6 & 12	A parking lot charges 50 cents for the first hour and 25 cents for each additional hour. How much does it cost to park for 4 hours? (A) $ .75 (B) $1.00 (C) $1.50 (D) $2.00 (E) Not given
				12	George had 85 cents. He bought 4 notebooks and had 5 cents left. How much did each notebook cost? (A) 10¢ (B) 20¢ (C) 21¢ (D) 80¢ (E) Not given
				6	Ruth saved 70 pennies in one jar and 32 pennies in another jar. How many pennies are in the jars? (A) 102 (B) 104 (C) 106 (D) 108 (E) Not given

3.1 ***Skill Area:*** Arithmetic Operations of Whole Numbers (Cont.)

3.11 (Cont.)	Solve verbal problems related to addition and subtraction.	c. Involving money in daily life situations	Translating the problem into mathematical equation and finding the solution to the problem	6	What is the change from a twenty-dollar bill if the purchase was $11.87? (A) $7.23 (B) $8.13 (C) $8.23 (D) $9.13 (E) Not given
3.12	Solve verbal problems related to addition, subtraction, multiplication, and division.	a. Involving daily life situations	Translating the problem into mathematical equation and finding the solution to the problem	6	There were 39 paint brushes for the art class. Each pupil had 2 brushes and there were 3 left over. How many pupils were in the class? (A) 18 (B) 19 (C) 36 (D) 44 (E) Not given
				6 & 12	A parking lot has 25 rows of parking spaces with 18 spaces for cars in each row. If 3 rows are removed for a driveway, what is the greatest number of cars which can be parked on the lot? (A) 375 (B) 396 (C) 414 (D) 447 (E) Not given
				6	We have 4 boxes of cookies. Each box has 18 square cookies. How many square cookies do we have altogether? (A) 22 (B) 30 (C) 34 (D) 72 (E) Not given
				6	I have 24 goldfish. I want to put 4 goldfish in each fish bowl. How many fish bowls do I need? (A) 6 (B) 12 (C) 22 (D) 30 (E) Not given
		b. Involving money in daily life situations	Translating the problem into mathematical equation and finding the solution to the problem	6	$15.65 is to be divided evenly among five persons. What is the amount that each person should receive? (A) $ .35 (B) $3.50 (C) $3.05 (D) $3.15 (E) $3.13
				6	If 12 pesos are worth one dollar, how many dollars equal 42 pesos? (A) 3 (B) $3\frac{1}{2}$ (C) $3\frac{3}{5}$ (D) 4 (E) Not given
				6	What is the value of 3 five-dollar bills, 4 one-dollar bills, 5 half-dollars, 3 quarters, 4 dimes, 7 nickels, and 11 pennies? (A) $4.30 (B) $22.61 (C) $23.06 (D) $23.11 (E) Not given
				6 & 12	A carpenter made the following purchase: 3 boxes of nails at $1.10 each; 1 hammer for $2.50; 2 screwdrivers at $ .89 each. The total bill before tax was: (A) $4.49 (B) $7.58 (C) $6.69 (D) $6.58 (E) $7.48

3.1 ***Skill Area:*** Arithmetic Operations of Whole Numbers (Cont.)

3.12 (Cont.)	Solve verbal problems related to addition, subtraction, multiplication, and division.	c. Involving measures of units of length, area, weight, or temperature	Translating the problem into mathematical equation and finding the solution to the problem using conversion	6 & 12	Joe had a piece of wood that was 2 yards long. He cut it into 6-inch pieces. How many pieces did he have? (A) 3 (B) 4 (C) 6 (D) 8 (E) Not given
				6	A bookshelf is 3 feet long. How many books can fit on the shelf if each book is 2 inches thick? (A) 5 (B) 6 (C) 10 (D) 18 (E) Not given
				12	On Monday the average temperature was 3° lower than on Tuesday. On Tuesday the average temperature was -15°. What was the average temperature on Monday? (A) -12° (B) 18° (C) -18° (D) 12° (E) None of these
				12	A girl lost 6 pounds during the first week of her diet, lost 5 pounds during the second week, gained 3 pounds the third week, and gained 8 pounds the fourth week. What was her net gain or loss for the four weeks? (A) 6 pound gain (B) 6 pound loss (C) 10 pound loss (D) 0 pounds (E) None of these
				12	The lowest point in Death Valley is 282 feet below sea level. The top of Mt. Whitney has an altitude of 14 495 feet above sea level. How high above Death Valley is Mt. Whitney? (A) 14 777 ft. (B) 14 213 ft. (C) 14 495 ft. (D) 282 ft. (E) None of these
		d. Involving numbers in scientific notation	Choosing the correct numeral for the solution of the word description of a real life problem	12	Light travels about 186×10^{3} miles per second. Using this number as the speed of light, how far does light travel in 1 minute? (A) $1\,116 \times 10^{4}$ miles (B) 11 160 miles (C) $1\,116 \times 10^{3}$ miles (D) 1 116 miles (E) None of these
				12	The earth's speed in its orbit around the sun is a little less than 7×10^{5} miles per hour. About how far does the earth travel in its yearly journey around the sun (365 days)? (A) 168×10^{5} miles (B) $2\,555 \times 10^{5}$ miles (C) $6\,132 \times 10^{6}$ miles (D) 8 760 miles (E) None of these

3.1 ***Skill Area:*** Arithmetic Operations of Whole Numbers (Cont.)

3.12 (Cont.)	Solve verbal problems related to addition, subtraction, multiplication, and division.	d. Involving numbers in scientific notation	Choosing the correct numeral for the solution of the word description of a real life problem	12	If a city government spends \$1 000 (1×10^3), per day for parks, then about how many years will it take to spend a billion dollars (1×10^9)? (A) 40 years (B) 100 years (C) 1×10^6 years (D) 2 740 years (E) None of these

3.2 ***Skill Area:*** Arithmetic Operations of Rational Numbers

3.21	Solve verbal problems related to addition and subtraction of rational numbers in fraction form.	a. Involving common and mixed fractions used in daily life context	Translating the problem into mathematical equation and finding the solution to the problem	6	Ann was mixing some punch for her friends. She mixed $1\frac{2}{3}$ cup orange juice and $4\frac{2}{3}$ cups ginger ale. How many cups of punch did she have? (A) $1\frac{2}{3}$ (B) 5 (C) $6\frac{1}{3}$ (D) $2\frac{2}{3}$ (E) Not given
				6	On Friday, the rainfall was $\frac{8}{10}$ of an inch. On Saturday, the rainfall was $\frac{1}{5}$ of an inch. How many inches of rain fell on these two days? (A) $\frac{7}{5}$ (B) $\frac{7}{10}$ (C) $\frac{9}{10}$ (D) $\frac{9}{15}$ (E) Not given
				6	Jack spent $\frac{3}{4}$ hour on Tuesday mowing the lawn. On Wednesday he spent $\frac{1}{2}$ hour pulling weeds. How many hours did Jack spend doing his work? (A) $\frac{3}{8}$ (B) $\frac{2}{3}$ (C) 1 (D) $1\frac{1}{4}$ (E) Not given
				6 & 12	Tom and Jerry went to a Little League game. It took Tom $\frac{1}{4}$ hour to get to the game, and it took Jerry $\frac{3}{4}$ hour. How much longer did it take Jerry to get to the game than Tom? (A) $\frac{1}{2}$ (B) $\frac{7}{8}$ (C) 1 (D) 3 (E) Not given
				6 & 12	Bob is $4\frac{2}{3}$ feet tall. Joe is $\frac{1}{3}$ foot shorter than Bob. How many feet tall is Joe? (A) $\frac{1}{3}$ (B) $4\frac{1}{3}$ (C) $4\frac{1}{2}$ (D) $4\frac{2}{3}$ (E) Not given
3.22	Solve verbal problems related to multiplication and division of rational numbers in fraction form.	a. Involving multiplication of a whole number or a fractional number with another fractional number in daily life context	Translating the problem into mathematical equation and finding the solution to the problem	6 & 12	If candy costs 80 cents a pound, how many cents does $\frac{3}{4}$ pound cost? (A) 20 (B) 30 (C) 60 (D) 70 (E) Not given
				6	Mary weighs $62\frac{1}{2}$ pounds. Her brother weighs $\frac{1}{2}$ as much as she weighs. How many pounds does he weigh? (A) 31 (B) $31\frac{1}{4}$ (C) $31\frac{1}{2}$ (D) 63 (E) Not given

3.2 ***Skill Area:*** Arithmetic Operations of Rational Numbers (Cont.)

3.22 (Cont.)	Solve verbal problems related to multiplication and/or division of rational numbers in fraction form.	a. Involving multiplication of a whole number or a fractional number with another fractional number in daily life context	Translating the problem into mathematical equation and finding the solution to the problem	6 & 12	Tim's dog eats $\frac{1}{4}$ pound of food in the morning and $\frac{1}{3}$ pound of food in the afternoon. How many pounds of food does Tim's dog eat during one week? (A) $\frac{1}{7}$ (B) $\frac{2}{7}$ (C) $\frac{7}{12}$ (D) $4\frac{1}{12}$ (E) Not given
				6	Three boys want to share 5 cupcakes. How many are there for each boy? (A) $1\frac{1}{3}$ (B) $1\frac{1}{2}$ (C) $1\frac{2}{3}$ (D) $1\frac{3}{4}$ (E) Not given
				6	One-half of the pupils in a school are going to a concert. These children will be taken in 5 buses. What fractional portion of the pupils of the school will ride in each bus? (A) $\frac{1}{10}$ (B) $\frac{1}{5}$ (C) $\frac{1}{4}$ (D) $\frac{1}{2}$ (E) Not given
				6	If 1 day is $\frac{1}{7}$ of a week, what part of the week is 12 hours? (A) $\frac{1}{14}$ (B) $\frac{1}{12}$ (C) $\frac{1}{7}$ (D) $\frac{1}{2}$ (E) Not given
3.23	Solve verbal problems related to addition-subtraction of rational numbers in decimal form.	a. Involving equal number of digits for whole number and fractional parts	Translating the problem into mathematical equation and finding the solution to the problem	6	A total of 3.2 inches of rain fell on Monday, 3.0 inches on Tuesday, and 2.4 inches on Wednesday. How many inches fell in the three days? (A) 8 (B) 8.6 (C) 86 (D) 566.2 (E) Not given
				6 & 12	One jet averaged 659.49 miles per hour on its test flight. Another jet averaged 701.10 miles per hour. How much greater was the average speed of the second plane, measured in miles per hour? (A) 41.52 (B) 41.61 (C) 41.79 (D) 158.39 (E) Not given
		b. Involving unequal number of digits for whole number and fractional parts	Translating the problem into mathematical equation and finding the solution to the problem	6 & 12	Mr. Long noticed that the mileage reading on his car was 8 523.4 when he bought some gas. During the day he traveled 49.3 miles. What was the reading at the end of the day? (A) 857.27 (B) 8 572.7 (C) 8 474.1 (D) 85 727 (E) Not given
				6	A barometer read 29.53 inches when a coming storm caused it to drop 0.67 inch. What does the barometer read with this drop in air pressure? (A) 28.86 (B) 28.96 (C) 30.20 (D) 1 978.51 (E) Not given

3.2 ***Skill Area:*** Arithmetic Operations of Rational Numbers (Cont.)

3.23 (Cont.)	Solve verbal problems related to addition-subtraction of rational numbers in decimal form.	b. Involving unequal number of digits for whole number and fractional parts	Translating the problem into mathematical equation and finding the solution to the problem	6	The Empire State Building in New York City is 1 250.0 feet high. The Statue of Liberty in New York Harbor is 305.5 feet high. How much higher is the Empire State Building than the Statue of Liberty, measured in feet? (A) 19.5 (B) 180.5 (C) 944.5 (D) 945.5 (E) Not given
3.24	Solve verbal problems related to multiplication-division of rational numbers in decimal form.	a. Multiplication/division of a decimal number with/by a whole number	Translating the problem into mathematical equation and finding the solution to the problem	6 & 12	If the average rainfall in a state is 2.7 inches per month, how many inches will fall in one year? (A) 8.1 (B) 24.84 (C) 32.4 (D) 324 (E) Not given
				6 & 12	If Tom's father can drive 18.7 miles on each gallon of gas, how many miles can he drive on 7 gallons? (A) 13.09 (B) 130.9 (C) 140.9 (D) 1 309 (E) Not given
				6	George lives 2.7 miles from school. He makes one round trip each school day. How many miles does he walk to and from school each week? (A) 4.14 (B) 5.4 (C) 13.5 (D) 37.8 (E) Not given

3.3 ***Skill Area:*** Arithmetic Operations Using Ratio, Proportion, and Percentage

3.31	Solve verbal problems related to ratios of whole numbers.	a. Involving daily life situations	Translating the problem into mathematical equation and finding the solution to the problem	6 & 12	The ratio of men to women attending a meeting was 4 to 5. If there were 20 women at the meeting, how many men were there? (A) 15 (B) 16 (C) 25 (D) 30 (E) Not given
				6	There are 36 students in a class. The ratio of boys to girls is 5:4. How many girls are there? (A) 16 (B) 17 (C) 18 (D) 20 (E) Not given
3.32	Solve verbal problems related to proportion of whole numbers.	a. Involving daily life situations	Translating the problem into mathematical equation and finding the solution to the problem	6 & 12	The manager of a prize fighter asked for $9 out of every $50 in the fighter's purse. If the fighter's purse came to $3 250, how much money did the manager get? (A) $65 (B) $361 (C) $361.01 (D) $361.10 (E) Not given
				6	I need 2 cups of sugar for 3 dozen cookies. How many cups of sugar will I need for 9 dozen cookies? (A) 5 (B) 6 (C) 8 (D) 14 (E) Not given

3.3 ***Skill Area:*** Arithmetic Operations Using Ratio, Proportion, and Percentage (Cont.)

3.32 (Cont.)	Solve verbal problems related to proportion of whole numbers.	a. Involving daily life situations	Translating the problem into mathematical equation and finding the solution to the problem	6	A parking area can accomodate 24 buses. If 5 cars can be parked in the space used by 3 buses, how many cars can be parked in the parking area? (A) 120 (B) 40 (C) 45 (D) 50 (E) 16
3.33	Solve verbal problems related to percent of whole number.	a. Involving daily life situations	Translating the problem into mathematical equation and finding the solution to the problem	6 & 12	If Tim gives Jim half of his candy bar, he gives him: (A) 1% (B) 20% (C) 50% (D) 100% (E) 200%
				6 & 12	One serving of Kernel Krunch cereal contains 3% of the minimum daily requirement of iron. What part of the minimum daily requirement of iron is in one serving of this cereal? (A) $\frac{1}{3}$ (B) $\frac{3}{100}$ (C) 3 (D) $\frac{3}{10}$ (E) Not given
				6 & 12	Jane spells 70% of the words on her spelling test correctly. There are 10 words on the test. How many words does she spell correctly? (A) 3 (B) 6 (C) 7 (D) 8 (E) 10
				6 & 12	On a stormy day there were 300 pupils present at Rogers Park School. This was 60% of the number of pupils enrolled. How many pupils were enrolled in the schools? (A) 50 (B) 180 (C) 360 (D) 500 (E) Not given
				6	Bill has done 40% of his arithmetic examples. He must do 50 in all. How many has he done? (A) 9 (B) 10 (C) 20 (D) 25 (E) 40
				6 & 12	A ball club has won 4 out of 8 games already played. If it wins the next two games, what percent of the games played will it then have won? (A) 6 (B) 60 (C) 75 (D) 80 (E) Not given
			Naming the percent of a number or naming the number which is a given percent of another number	6 & 12	If Tim gives Jim half of his candy bar, he gives him: (A) 1% (B) 20% (C) 50% (D) 100% (E) 200%
				12	There are 590 students in Oakdale School, and 20% are in this year's graduating class. How many students will graduate this year? (A) .20 x 590 (B) $\frac{590}{20}$ (C) 20 x 590 (D) $\frac{590}{.2}$

3.3 ***Skill Area:*** Arithmetic Operations Using Ratio, Proportion, and Percentage (Cont.)

3.33 (Cont.)	Solve verbal problems related to percent of whole number.	a. Involving daily life situations	Naming the percent of a number or naming the number which is a given percent of another number	12	Ralph bought a watch at a store which offered a discount of 12 percent on all merchandise. The discount amounted to $3.90. What was the original price? (A) $\frac{\$3.90}{12}$ (B) $\frac{\$3.90}{.12}$ (C) 12 x $3.90 (D) .12 x $3.90
			Naming the correct numeral for the solution of the word description of a real life problem	12	George works 15 hours a week at a market and earns $2.20 an hour. If 15% of his weekly check is withheld for taxes and insurance, then how much is his take-home pay? (A) $33.00 (B) $28.05 (C) $220. (D) $37.95 (E) Not given
				6 & 12	Compute the sales tax on a purchase of $20.00 if the tax rate is 5%. (A) $ .10 (B) $1.00 (C) $10.00 (D) $2.00 (E) Not given
				6 & 12	What is the simple interest on $400 at 7% for 3 years? (A) $8.40 (B) $12.00 (C) $28.00 (D) $84.00 (E) Not given

4.0 SUBCONTENT AREA: ALGEBRAIC COMPUTATION

4.1 *Skill Area:* Algebraic Linear Equations

Level	*Subskill Area*	*Illustrative Item Specification*		*Grade Level*	*Example*
		Subskill	*Performance Mode*		
4.11	Determine the sum of two monomials.	a. Involving two like algebraic monomials	Naming the correct sum	12	$3s + 3s = \square$ (A) 9s (B) 3s (C) 6s (D) $9s^2$ (E) Not given
		b. Involving two unlike algebraic monomials and their inverse	Naming the correct sum	12	$3x + 2y = \square$ (A) 5xy (B) 6xy (C) 6x (D) 3x + 2y (E) Not given
4.12	Determine the difference of two monomials.	a. Involving two like algebraic monomials	Naming the correct remainder	12	$4y - 2y = \square$ (A) 2y (B) 2 (C) 0 (D) y (E) Not given
4.13	Determine the product of two monomials.	a. Involving one whole number and one algebraic monomial	Naming the product	12	$(5)(3a) = \square$ (A) 8a (B) 15a (C) 15 (D) a (E) Not given
4.14	Determine the quotient of two monomials.	a. Involving one algebraic monomial and one whole number	Naming the quotient	12	$12a \div 3 = \square$ (A) 4 (B) $\frac{1}{3}$ (C) a (D) 4a (E) Not given
4.15	Determine the numerical value of an algebraic expression, given the value of variables.	a. Involving the sum of a monomial and a whole number	Naming the numerical value	12	If x=5, then $2x + 4 = \square$ (A) 18 (B) 14 (C) 30 (D) 20 (E) Not given
		b. Involving the sum of two monomials	Naming the numerical value	12	If x=10 and y=3 then $2x + 3y = \square$ (A) 26 (B) 20 (C) 52 (D) 15 (E) Not given
		c. Involving the sum of second power monomials	Naming the numerical value	12	If x=5, and y=12, then $x^2 + y^2 = \square$ (A) 249 (B) 17 (C) 35 (D) 169 (E) Not given
		d. Involving the difference of a monomial and a whole number	Naming the numerical value	12	If x=-5, then $x-3 = \square$ (A) 8 (B) 2 (C) -8 (D) -2 (E) Not given
		e. Involving the product of a monomial and a whole number	Naming the numerical value	12	If $x = \frac{1}{5}$, then $7x = \square$ (A) $\frac{7}{5}$ (B) $\frac{1}{35}$ (C) 35 (D) 7 (E) Not given
4.16	Solve simple linear equations.	a. Involving a binomial expression containing one variable equated to a whole number	Naming the variable value	12	If $x + 5 = 13$, then $x = \square$ (A) 18 (B) $\frac{22}{5}$ (C) 8 (D) 65 (E) Not given

4.1 ***Skill Area:*** Algebraic Linear Equations (Cont.)

4.16 (Cont.)	Solve simple linear equations.	b. Involving a binomial expression containing a variable with a coefficient greater than 1 equated to a whole number	Naming the variable value	12	If $9x - 63 = 18$, then $x = \square$ (A) -9 (B) -5 (C) 5 (D) 9 (E) Not given
		c. Involving two binomial expressions in the same variables being equated	Naming the variable value	12	If $5x - 2 = 10 - 7x$, then $x = \square$ (A) 1 (B) $\frac{2}{3}$ (C) $\frac{10}{3}$ (D) 6 (E) Not given
		d. Involving a variable with a unit fraction for a coefficient equated to a rational number	Naming the variable value	12	If $\frac{x}{4} = \frac{3}{2}$, then $x = \square$ (A) 5 (B) 6 (C) 9 (D) 24 (E) Not given
		e. Involving a variable with a unit fraction for a coefficient equated to a whole number	Naming the variable value	12	If $\frac{x}{4} = 3$, then $x = \square$ (A) 7 (B) $\frac{3}{4}$ (C) 12 (D) $\frac{4}{3}$ (E) Not given
		f. Involving inverse of a variable equated to a fractional or decimal number	Naming the variable value	12	If $\frac{1}{y} + \frac{2}{3y} = \frac{1}{3}$, then $y = \square$ (A) 5 (B) $\frac{6}{2}$ (C) $\frac{2}{9}$ (D) 0.2 (E) Not given

5.0 SUBCONTENT AREA: ALGEBRAIC COMPREHENSION

5.1 *Skill Area:* Algebraic Expressions and Formulas

Level	*Subskill Area*	*Illustrative Item Specification*		*Grade Level*	*Example*
		Subskill	*Performance Mode*		
5.11	Identify algebraic expression.	a. Involving addition of a variable and a number given as a word description	Naming or choosing the algebraic expression	12	The expression that represents the phrase, "7 more than a number x " is: (A) 7x (B) 7+x (C) 7-x (D) $\frac{7}{x}$ (E) None of these
				12	A word description of the expression, "x+3 is: (A) "Three times a number x" (B) "Three more than a number x" (C) "The number x decreased by 3" (D) "The quotient of x and 3" (E) None of these
		b. Involving addition of a variable and some multiple of the variable given as a word description	Naming or choosing the algebraic expression	12	The expression that represents the phrase, "the sum of a number x and twice the number x," is: (A) x+2x (B) x+2 (C) x+x (D) $2x^2$ (E) None of these
				12	A word description of the expression, "2n-5," is: (A) "Five less than a number n" (B) "Three less than a number n" (C) "A number n decreased by 5 and then doubled" (D) "Five less than twice a number n" (E) None of these
		c. Involving division of a variable by a whole number given as a word description	Naming or choosing the algebraic expression	12	The expression that represents this phrase, "the quotient of x divided by 10," is: (A) x+10 (B) 10x (C) x-10 (D) $\frac{x}{10}$ (E) None of these
				12	A word description of the expression, "$\frac{12}{n+1}$" is: (A) "The difference between 12 and the sum of a number n and one" (B) "The product of 12 and the sum of a number n and one" (C) "The sum of 12 and the number n increased by one" (D) "Twelve divided by the sum of a number n, and one" (E) None of these

5.1 ***Skill Area:*** Algebraic Expressions and Formulas (Cont.)

5.11 (Cont.)	Identify algebraic expression.	d. Involving simple algebraic expression given as word description	Naming or choosing the algebraic expression	12	The expression that represents the phrase, "the number of cents in one more than n nickels," is: (A) 5n+1 (B) 5n (C) 5(n+1) (D) n+5 (E) None of these
5.12	Identify algebraic formulas.	a. Involving word description of the formula	Naming or choosing the algebraic formula	12	The area, A, of a triangular region is $\frac{1}{2}$ of the product of the length of its base, b, and its altitude, h. (A) $A=\frac{1}{2}+b+h$ (B) $A=\frac{1}{2}+bh$ (C) $A=\frac{1}{2}bh$ (D) $A=\frac{b+h}{2}$ (E) None of these
				12	The simple interest, i, is the product of the amount borrowed, p, the rate of interest per year, r, and the time in years, t. (A) i=prt (B) i=p+r+t (C) $i=\frac{p+t}{r}$ (D) $i=\frac{p+r}{t}$ (E) None of these
				12	The Celsius temperature, C, is the product of the Fahrenheit temperature, F, decreased by 32 and $\frac{5}{9}$. (A) $C=\frac{5}{9}F-32$ (B) $C=\frac{5}{9}(F-32)$ (C) $C=F-(\frac{5}{9})(32)$ (D) $C=\frac{5}{9}F-(\frac{5}{9})(32)$ (E) None of these

5.2 ***Skill Area:*** Number Sentences -- Linear Equations

5.21	Identify equivalent linear equations in one variable.	a. Involving variable with a coefficient of 1	Naming/choosing equivalent equation having the same solution	12	Which of these equations has the same solution as x-5=23? (A) x+23=5 (B) 23=5-x (C) 23-5=x (D) 23+5=x (E) None of these
				12	Which of these equations has the same solution as 3x=7? (A) 7x=3 (B) $3=\frac{x}{7}$ (C) $x=\frac{3}{7}$ (D) $\frac{7}{3}=\frac{x}{3}$ (E) None of these
		b. Involving simple first power equations with the variable having a coefficient greater than 1	Naming/choosing equivalent equation having the same solution	12	Which of these equations has the same solution as 3x-2=4? (A) 3x+2=2 (B) 3x=2 (C) 3x+4=2 (D) x=2 (E) None of these

5.2 ***Skill Area:*** Number Sentences -- Linear Equations (Cont.)

5.22	Construct a simple linear equation.	c. Involving addition, subtraction, multiplication, and division of a variable and a number, given as word description	Constructing or choosing the sentence	12	Choose the equation that can be used to solve this problem: "Tom has 8 marbles. Three are red. The rest are green. How many are green?" (A) 3+x=8 (B) 3x=8 (C) 3-x=8 (D) x=8+3 (E) None of these
				12	Choose the equation that can be used to solve this problem: "Ann has 30 cents to spend for pencils. Each pencil costs 5 cents. How many pencils can Ann buy?" (A) 5+x=30 (B) 30-x=5 (C) 5x=30 (D) 5=30x (E) None of these
				12	Choose the equation that can be used to solve this problem: "Marge paid twice as much as Bruce for her school shoes. If they spent 36 dollars altogether, how much did Bruce spend for his shoes?" (A) 2x=36 (B) x+x=36 (C) 2x+2=36 (D) 2x+x=36 (E) None of these

5.3 ***Skill Area:*** Functions and Graphs

5.31	Identify basic parts and characteristics of the real number plane.	a. Involving origin on the real number plane	Identifying the point indicating the origin	12	In the drawing, point A is called the: (A) abscissa (B) ordinate (C) coordinate (D) origin (E) Not given
		b. Involving coordinates of a point on the real number plane	Naming the coordinate of a point	12	In the drawing, point C has the coordinates: (A) (-8,3) (B) (8,3) (C) (-8,-3) (D) (8,-3) (E) None of these
		c. Involving a specific quadrant on the real number plane	Locating a point in a specific quadrant	12	In the drawing above which point is in the 4th quadrant? (A) point D (B) point A (C) point E (D) point C (E) None of these
		d. Involving points having both x and y coordinates the same value	Naming points with both x and y value identical	12	In the drawing above, these points have both x and y coordinates that are equal: (A) A and B (B) A and C (C) A and D (D) A and E (E) None of these

5.3 ***Skill Area:*** Functions and Graphs (Cont.)

5.32	Identify and apply the function rule.	e. Involving addition, subtraction, multiplication, division, percents, or exponentiation	Preparing or choosing a chart of given values and values based on the function rule	12	The formula $A=s^2$ represents the area of a square region with sides of length s. Identify the table that shows the area of square regions with sides of length 2, 4, 8, and 16

s	A
2	4
4	8
8	16
16	32

(A)

s	A
2	4
4	16
8	64
16	256

(B)

s	A
2	8
4	32
8	128
16	256

(C)

s	A
2	6
4	12
8	24
16	48

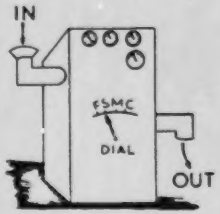
(D)

(E) None of these

12

We find a number machine that changes numbers. We set the dial and put in our numbers. Study this table and then answer the next two questions.

We put in	We get
3	7
10	14
6	10
27	31
13	□
□	39



a. If we put 13 in, what number do we get out?
(A) 13 (B) 9 (C) 20 (D) 17 (E) 4

b. What number do we put in to have 39 come out?
(A) 31 (B) 39 (C) 32 (D) 29 (E) 40

47

6.0 SUBCONTENT AREA: ALGEBRAIC APPLICATIONS

6.1 *Skill Area:* Mathematical Sentences and Formulas

Level	*Subskill Area*	*Illustrative Item Specification*		*Grade Level*	*Example*
		Subskill	*Performance Mode*		
6.11	Construct algebraic sentences or phrases to solve problems.	a. Involving addition, subtraction, multiplication, or division sentences	Choosing the phrase representing the model for the situation	12	Which formula represents the number of cents in d dollars and k quarters? (A) d+k (B) (125)(d+k) (C) 100d+25k (D) dk (E) None of these
				12	Which formula represents the yearly salary of a man who earns x dollars a month? (A) 12x (B) x+12 (C) $\frac{x}{12}$ (D) 12-x (E) None of these
				12	Which formula represents the number of hours in y seconds? (A) 60y (B) $\frac{y}{60}$ (C) 3 600y (D) $\frac{y}{3\,600}$ (E) None of these
				12	Which formula represents the distance between two airplanes that fly in opposite directions from the same airport for t hours if the first plane flies at an average speed of 350 miles per hour and the second plane flies at an average speed of 600 miles per hour? (A) 600t-350t (B) 600t+350t (C) 250t (D) 425t (E) None of these
6.12	Construct and solve algebraic formulas.	a. Involving word descriptions of formulas in daily life situations	Naming the value using the given values of the variables	12	The distance a car travels, d, equals the average speed, r, multiplied by the time traveled, t. How far does a car travel in 5 hours at 75 kilometres per hour? (A) 70 kilometres (B) 80 kilometres (C) 375 kilometres (D) 25 kilometres (E) None of these

6.1 ***Skill Area:*** Mathematical Sentences and Formulas (Cont.)

6.12 (Cont)	Construct and solve algebraic formulas.	a. Involving word descriptions of formulas in daily life situations	Naming the value using the given values of the variables	12	A person's approximate normal systolic blood pressure, P, in millimetres, is the sum of one-half his age, y, in years and 100. What is the approximate normal systolic blood pressure of a person who is 22 years old? (A) 61 millimetres (B) 111 millimetres (C) 72 millimetres (D) 144 millimetres (E) None of these
				12	Sound travels, at sea level, x feet per second. Which equation represents the conversion of the speed of sound to miles per hour? (A) $v=\frac{3\,600x}{5\,280}$ (B) $v=\frac{5\,280x}{3\,600}$ (C) $v=\frac{60x}{5\,280}$ (D) $v=\frac{5\,280x}{60}$ E) None of these
				12	What is the cost of a \$7.50 shirt if the sales tax rate is 6%? (A) \$45 (B) \$7.05 (C) \$52.50 (D) \$7.95 (E) None of these

6.2 ***Skill Area:*** Mathematical Functions and Graphs

6.21	Solve problems of interpretation of data in tabular form.	a. Involving problems in daily life situations	Providing required information from tabular data	6 & 12	This table represents the quiz scores of a student for each of the first ten weeks of school. Each quiz had 30 points possible.

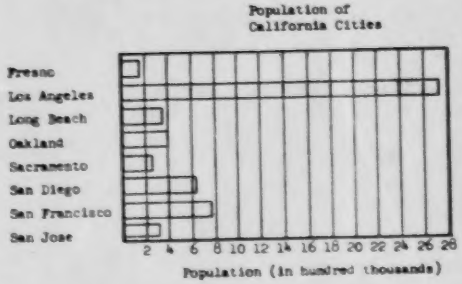
Week	1	2	3	4	5	6	7	8	9	10
Score	15	17	20	17	21	25	24	26	27	27

1. How many scores were below 20?
   (A) 0 (B) 1 (C) 2 (D) 3 (E) Not given
2. In which weeks were the scores the same?
   (A) 2 and 4 (B) 1 and 6 (C) 7, 9, and 10
   (D) B and C (E) Not given
3. Is the student improving over the ten week period?
   (A) Yes (B) No
4. The class average for all ten scores was 22. Was this student's average above or below the class average?
   (A) Below (B) Above (C) Same

6.2 ***Skill Area:*** Mathematical Functions and Graphs (Cont.)

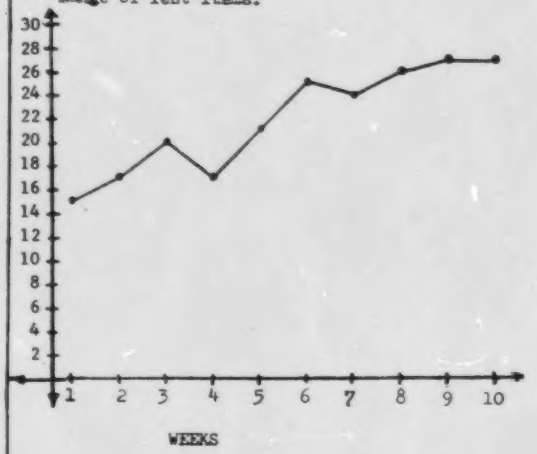
6.21 (Cont.)	Solve problems of interpretation of data in tabular form.	a. Involving problems in daily life situations	Providing required information from tabular data	6 & 12	5. In what two week period did the student improve the most? (A) 1, 3 (B) 3, 5 (C) 4, 6 (D) 7,9 (E) Not given AMERICAN LEAGUE Eastern Division Team / Games Won / Games Lost Detroit 34 19 Cleveland 31 23 Baltimore 28 24 Milwaukee 29 26 Boston 26 27 Totals 148 119 Which team played the most games? (A) Detroit (B) Cleveland (C) Milwaukee (D) Boston (E) Baltimore How many teams have won more than half of their games? (A) 1 (B) 2 (C) 3 (D) 4 (E) 5 How many teams have played exactly 53 games? (A) 5 (B) 4 (C) 3 (D) 2 (E) 1 Which of these numbers most closely represents the average number of games played by these teams? (A) 266 (B) 27 (C) 34 (D) 26 (E) 53
				12	If you know that a state's sales tax is $ .06 for every dollar, then a table that shows the actual price of items that are listed for $1, $5, $10, $20, and $25 is: I List Price / Actual Price $ 1 / $ 1 $ 5 / $ 5 $10 / $10 $20 / $20 $25 / $25 II List Price / Actual Price $ 1 / $ .60 $ 5 / $ 3.00 $10 / $ 6.00 $20 / $12.00 $25 / $15.00 III List Price / Actual Price $ 1 / $ 1.06 $ 5 / $ 5.30 $10 / $10.60 $20 / $21.20 $25 / $26.50 (A) I (B) II (C) III (D) None of these tables

6.2 ***Skill Area:*** **Mathematical Functions and Graphs (Cont.)**

6.22	Interpret the functional relationship provided by word description.	a. Involving problems in daily life situations	Decoding functional relationship and providing required new information	6 & 12	Jane can run 50 yards in 10 seconds. At the same rate, how long does it take Jane to run 100 yards? (A) 12 seconds (B) 20 seconds (C) 15 seconds (D) 5 seconds (E) a half hour At the same rate, how long does it take Jane to run 70 yards? (A) 16 seconds (B) 12 seconds (C) 20 seconds (D) 14 seconds (E) 22 seconds At the same rate, how far can Jane run in 8 seconds? (A) 60 yards (B) 50 yards (C) 40 yards (D) 30 yards (E) 20 yards
6.23	Solve problems of interpretation of data given as bar graph.	a. Involving problems in daily life situations	Interpreting and providing required information from the reading on the reference line	6 & 12	 The population of San Francisco is most nearly equal to the combined populations of: (A) Sacramento and Fresno (B) Long Beach and Oakland (C) San Diego and San Jose (D) Los Angeles and Fresno (E) San Diego and Sacramento According to the graph, the largest city is approximately [?] times as large as San Jose? (A) 6 (B) 7 (C) 8 (D) 9 (E) 12

6.2 ***Skill Area:*** Mathematical Functions and Graphs (Cont.)

6.24	Solve problems of interpretation of data given as a line or a high-low graph.	a. Involving problems in daily life situations	Interpreting and providing required information from the reading on the reference lines	6 & 12	Range of Test Items:



This graph represents the quiz scores of a student for each of the first ten weeks of school. Each quiz had 30 points possible.

How many scores were below 20?

(A) 0 (B) 1 (C) 2 (D) 3 (E) Not given

In which weeks were the scores the same?

(A) 2, 4 (B) 1, 6 (C) 7, 9, 10

(D) B and C (E) Not given

Is the student improving over the ten week period?

(A) Yes (B) No

The class average for all ten scores was 22. Was this student's average above or below the class average?

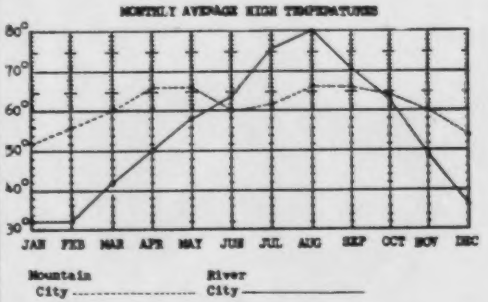
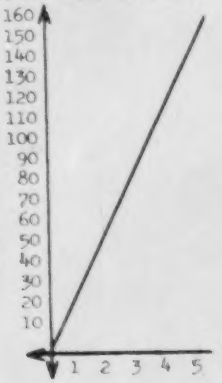
(A) Below (B) Above (C) Same

In what two week period did the student improve the most?

(A) 1, 3 (B) 3, 5 (C) 4, 6 (D) 7, 9

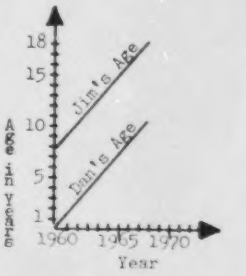
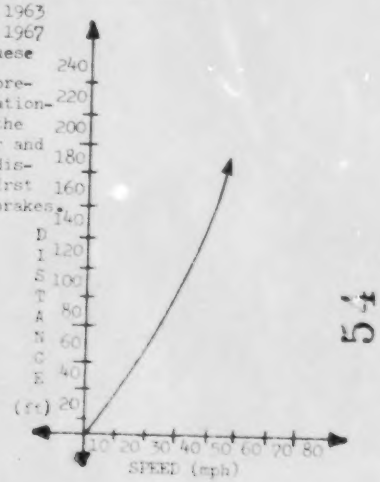
(E) Not given

6.2 ***Skill Area:*** Mathematical Functions and Graphs (Cont.)

6.24 (Cont.)	Solve problems of interpretation of data given as a line on a high-low graph.	a. Involving problems in daily life situations	Interpreting and providing required information from the reading on the reference lines	6 & 12	 The average high temperature for Mountain City in the month of September is: (A) 66° (B) 63° (C) 71° (D) 72° (E) 81° In which month does River City have the coldest average temperatures? (A) January (B) March (C) June (D) August (E) December In what month are the average temperatures further apart than in any other month of the year? (A) February (B) March (C) October (D) November (E) December In what two month period is the least amount of change in average temperatures noted for River City? (A) December-January (B) June-July (C) July-August (D) November-December (E) None of these
6.25	Solve problems of interpretation of data given as linear graph.	a. Involving linear relationship in two variables in daily life situations	Interpreting and eliciting desired information from the reading on the reference lines	12	This graph shows the distance traveled, in miles, at an average speed of 30 mph for up to 6 hours of traveling time. What was the distance traveled in 3 hours? (A) 33 miles (B) 30 miles (C) 60 miles (D) 90 miles (E) Not given 

53

6.2 ***Skill Area:*** Mathematical Functions and Graphs (Cont.)

6.25 (Cont.)	Solve problems of interpretation of data given as linear graph.	a. Involving linear relationship in two variables in daily life situations	Interpreting and eliciting desired information from the reading on the reference lines	12	About how many miles were traveled in $4\frac{1}{2}$ hours? (A) $34\frac{1}{2}$ miles (B) 120 miles (C) 135 miles (D) 145 miles (E) Not given How many hours did it take to travel 45 miles? (A) $1\frac{1}{2}$ (B) 2 (C) $2\frac{1}{2}$ (D) 3 (E) Not given For every increase of one hour of time, the graph shows: (A) a decrease in the distance traveled (B) an increase in the distance traveled (C) no change in the distance traveled (D) None of these This graph represents the ages of two boys during a ten year period. Jim was exactly 8 years old when Dan was born in 1960. Jim and Dan were the same age in: (A) 1960 (B) 1965 (C) 1968 (D) 1970 (E) None of these  Jim was twice as old as Dan in: (A) 1960 (B) 1964 (C) 1968 (D) 1972 (E) None of these Jim was nine times as old as Dan in: (A) 1961 (B) 1963 (C) 1965 (D) 1967 (E) None of these
6.26	Solve problems of interpretation of data given as curvilinear graph.	a. Involving monotonic relationship in two variables presented in daily life situations	Providing the information from the reading on the reference lines	12*	This graph represents the relationship between the speed of a car and the stopping distance after first applying the brakes. 

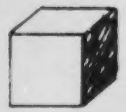
* Not included in the 1974-75 version of the Survey of Basic Skills.

6.2 ***Skill Area:*** Mathematical Functions and Graphs (Cont.)

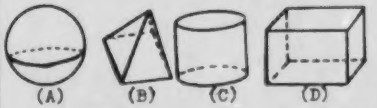
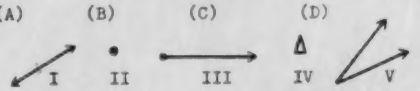
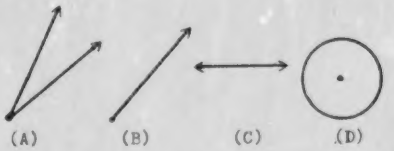
6.26 (Cont.)	Solve problems of interpretation of data given as curvilinear graph.	a. Involving monotonic relationship in two variables presented in daily life situations	Providing the information from the reading on the reference lines	12	Use the graph to find the approximate distance needed to stop a car if its speed is 50 mph. (A) 50 ft. (B) 120 ft. (C) 180 ft. (D) 200 ft. (E) Not given If a car was traveling 60 mph, the stopping distance would be: (A) greater than 200 ft. (B) less than 200 ft. (C) 200 ft. (D) 60 ft. (E) None of these If the skid marks were 150 ft. long, about how fast was the car traveling when the brakes were first applied? (A) 25 mph (B) 35 mph (C) 45 mph (D) 55 mph (E) 65 mph

7.0 SUBCONTENT AREA: GEOMETRIC KNOWLEDGE OF FACTS

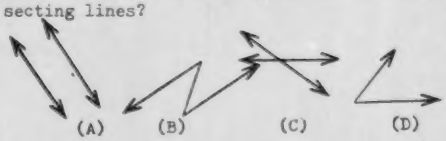
7.1 ***Skill Area:*** Geometric Figures

Level	*Subskill Area*	*Illustrative Item Specification*		*Grade Level*	*Example*
		Subskill	*Performance Mode*		
7.11	Identify parts of geometric shapes.	a. Plane or flat surfaces	Choosing the object which has flat surface	6	Which object below shows a flat surface? (A) I (B) II (C) III (D) None of these (I) (II) (III)
		b. Edge	Choosing the object which has edges	6	Identify the object above which has edges. (A) I (B) II (C) III (D) None of these
7.12	Classify angles.	a. Right angle	Choosing correct pictorial representation	6 & 12	 (A) (B) (C) (D) Which of the above drawings is a right angle? (A) (B) (C) (D)
		b. Acute angle	Choosing correct pictorial representation	6 & 12	Which of the above drawings is an acute angle? (A) (B) (C) (D)
		c. Obtuse angle	Choosing correct pictorial representation	6 & 12	Which of the above drawings is an obtuse angle? (A) (B) (C) (D)
7.13	Identify geometric solids.	a. Cube	Identifying the name which goes with pictorial representation	6 & 12	This is a picture of: (A) a square (B) a circle (C) a triangle (D) a cube (E) a rectangle 

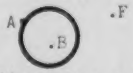
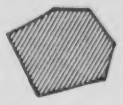
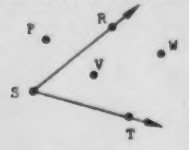
7.1 ***Skill Area:*** Geometric Figures (Cont.)

7.13 (Cont.)	Identify geometric solids.	b. Cylinder	Identifying the name which goes with pictorial representation	6 & 12	Which of these is a picture of a cylinder?  (A) (B) (C) (D)
		c. Rectangular solid	Identifying the name which goes with pictorial representation	6 & 12	Which of the above is a picture of a rectangular solid? (A) (B) (C) (D)
		d. Sphere	Identifying the name which goes with pictorial representation	6 & 12	Which of the above is a picture of a sphere? (A) (B) (C) (D)
		e. Pyramid	Identifying the name which goes with pictorial representation	6 & 12	Which of the above is a picture of a pyramid? (A) (B) (C) (D)  I II III IV V
7.14	Identify basic geometric terms and sets.	a. Point	Choosing correct pictorial representation	6 & 12	Which of the figures above is commonly used to represent a point? (A) Figure I (B) Figure II (C) Figure III (D) Figure IV (E) Figure V
		b. Line c. Plane d. Line segment e. Ray		6 & 12	Which of the figures above is commonly used to represent a line? (A) Figure I (B) Figure II (C) Figure III (D) Figure IV (E) Figure V
7.15	Identify the union or intersection of basic geometric sets.	a. Angle	Choosing correct pictorial representation	6 & 12	Which figure shows an angle?  (A) (B) (C) (D)
		b. Triangles (equilateral, isosceles, and right), rectangles, quadrilaterals	Choosing correct pictorial representation	6 & 12	Which of the following is a picture of a rectangle? (A) (B) (C) (D) None of these

7.1 ***Skill Area:*** Geometric Figures (Cont.)

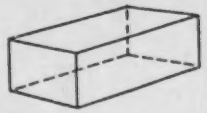
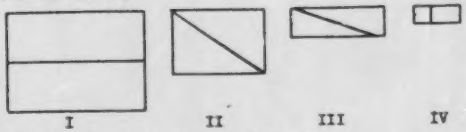
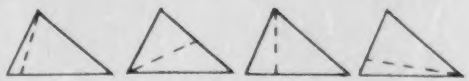
7.15 (Cont.)	Identify the union or intersection of basic geometric sets.	c. Triangles (equilateral, isosceles, and right), rectangles, quadrilaterals	Choosing correct pictorial representation	6 & 12	The shaded shapes in the figure are: (A) Squares (B) Rectangles (C) Triangles (D) Circles (E) Rhombuses
7.16	Determine relationship between two lines in a plane.	a. Intersecting	Choosing from pictorial representations involving rays, segments, and lines	12	Which of these figures represents two intersecting lines?  (A) (B) (C) (D)
		b. Parallel	Choosing from pictorial representations involving rays, segments, and lines	12	Which of these figures represents two parallel lines? None of these (A) (B) (C) (D) (E)
		c. Perpendicular		12	Which of these figures represents two perpendicular lines? None of these (A) (B) (C) (D) (E)

7.2 ***Skill Area:*** Geometric Symbols, Terms, and Postulates

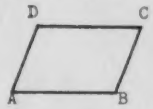
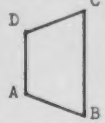
7.21	Determine location of a point.	a. On a geometric figure	Naming the point	6 & 12	Here is a drawing of a circle and some points:  Which letter names a point on the circle? (A) A (B) B (C) F (D) A and B
		b. In the interior of a geometric figure	Identifying the region	6 & 12	The shaded area is: (A) Inside the figure (B) On the figure (C) The perimeter of the figure (D) Outside the figure (E) A simple closed curve 
		c. In the exterior of a geometric figure	Naming the point	6 & 12	Which of the points are in the exterior of angle RST? (A) P only (B) V and W only (C) V, T, and W only (D) R, S, and T only 

8.0 SUBCONTENT AREA: GEOMETRIC COMPREHENSION

8.1 *Skill Area:* Components of Geometric Figures

Level	*Subskill Area*	*Illustrative Item Specification*		*Grade Level*	*Example*
		Subskill	*Performance Mode*		
8.11	Identify segments or points related to polygons and circles.	a. Line segment	Identifying line segment in a geometric solid	6	Which parts of this rectangular block remind you most of a line segment? (A) The corners (B) The edges (C) The faces (D) The region inside the block (E) Not given 
		b. Diagonal of a rectangle	Choosing a correct pictorial representation	6 & 12	 I II III IV Which figure shows a diagonal? (A) I (B) II (C) III (D) IV (E) Not given
		c. Diameter or chord of a circle	Choosing a correct pictorial representation	6 & 12	 I II III IV Which figure shows a diameter? (A) I (B) II (C) III (D) IV (E) Not given
		d. Altitude of a triangle	Choosing a correct pictorial representation	6 & 12	 Which figure shows an altitude? (A) I (B) II (C) III (D) IV (E) Not given
		e. Points inside or outside a circle	Choosing a point in relation to parts of the circle	6 & 12	Point A is nearer to P than to point O. Point A must be P. O (A) On the circle (B) Outside the circle (C) Inside the circle (D) Not given

8.1 ***Skill Area:*** Components of Geometric Figures (Cont.)

8.11 (Cont.)	Identify segments or points related to polygons and circles.	f. Radius or diameter of a circle	Choosing a correct pictorial representation	6	How many diameters are shown in this figure? (A) 1 (B) 2 (C) 3 (D) 4 (E) 6
		g. Vertices of an octagon	Choosing a correct pictorial representation	6 & 12	How many vertices does this figure have? (A) 2 (B) 4 (C) 6 (D) 8 (E) Not given
		h. Opposite sides of a quadrilateral	Choosing a correct pictorial representation	12	In this figure, a pair of opposite sides is: (A) AB and BC (B) AB and CD (C) AB and DA (D) AC and BD (E) None of these 
		i. Parallel sides of a quadrilateral (trapazoid)	Choosing a correct pictorial representation	12	In this figure a pair of parallel sides is: (A) AD and AB (B) AD and BC (C) AD and CD (D) AB and CD (E) None of these 

8.2 ***Skill Area:*** Geometric Properties and Postulates

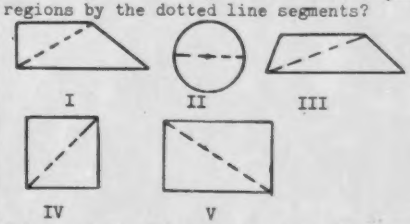
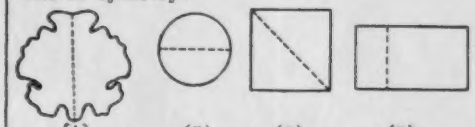
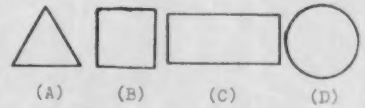
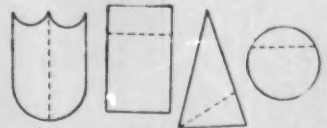
8.21	Recognize basic postulates involving points, lines, and planes.	a. Two intersecting lines have a point in common	Choosing correct conclusion for stated situation	6 & 12	If two different lines intersect, then their intersection is: (A) a line segment (B) a line (C) a point (D) two points (E) Not given
		b. Two points determine a line	Choosing appropriate array of points to conform the definition	6 & 12	In which of these figures is it possible to draw infinitely many lines through <u>all</u> of the points? (A) W (B) W Y (C) W Y Z (D) W Y Z (E) None of these
		c. Intersecting planes have a line in common	Choosing correct conclusion for stated situation	6 & 12	If two different planes intersect, then their intersection is: (A) a line segment (B) a line (C) a point (D) three points (E) None of these
		d. Parallel lines do not intersect each other	Choosing correct conclusion for stated situation	6 & 12	If two different lines are parallel, then the number of points in their intersection is: (A) none (B) one (C) two (D) three (E) infinitely many
		e. Through one point infinitely many lines can be drawn	Choosing appropriate array of points to conform the definition	6 & 12	In which of these figures is it possible to draw one and only one line through <u>all</u> of the given points? (A) W (B) W Y (C) W. .Z .Y (D) X. Z. .W .Y (E) None of these

8.2 *Skill Area:* Geometric Properties and Postulates (Cont.)

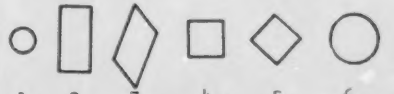
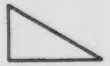
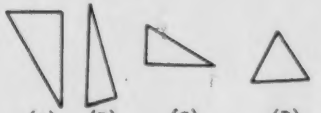
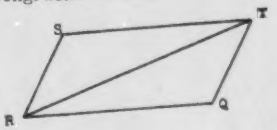
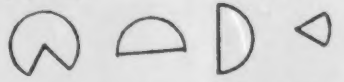
8.21 (Cont.)	Recognize basic postulates involving points, lines, and planes.	f. A line separates the plane into two regions	Choosing correct conclusion for stated situation	6 & 12	A line in a plane separates the plane into: (A) one region (B) two regions (C) three regions (D) more than three regions (E) Not given.
		g. A line in a plane has at least two points in common	Choosing correct conclusion for stated situation	6 & 12	If a line and a plane have two points in common, the line (A) is perpendicular to the plane (B) is parallel to the plane (C) lies in the plane (D) None of the above
		h. For two intersecting planes there is a plane having points equidistant from two intersecting planes	Choosing correct conclusion for stated situation	6 & 12	If two planes intersect, the set of points equidistant from both the planes, lies in (A) a straight line (B) a plane (C) a circle (D) None of the above
		i. From a point only 3 rays can be drawn which are mutually perpendicular	Choosing correct conclusion for stated situation	6 & 12	How many rays can be drawn from a point so that each ray is perpendicular to every other ray? (A) 1 (B) 2 (C) 3 (D) Not given
		j. Three non-collinear points determine a plane	Choosing correct conclusion for stated situation	6 & 12	If three points are <u>not</u> in a straight line, then how many different planes will contain them? (A) None (B) One (C) Two (D) Three (E) An infinite number
		k. Through a point not on the line, one and only one perpendicular can be drawn on the line	Choosing correct conclusion for stated situation	6 & 12	In a plane, how many lines can be drawn perpendicular to a given line through a point <u>not</u> on the line? (A) 0 (B) 1 (C) 2 (D) 3 (E) More than can be counted
				6 & 12	In a plane, how many lines can be drawn perpendicular to a given line? (A) 0 (B) 1 (C) 2 (D) 3 (E) More than can be counted
				6 & 12	In a plane, how many lines can be drawn perpendicular to a given line through a point <u>on</u> the given line? (A) 0 (B) 1 (C) 2 (D) 3 (E) More than can be counted

61

8.3 *Skill Area:* Relationships Between Geometric Sets

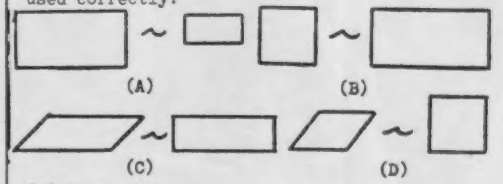
8.31	Identify symmetry of a line.	a. Involving various geometrical shapes	Choosing correct pictorial representation	6 & 12	Which figures are separated into two symmetrical regions by the dotted line segments?  I II III IV V (A) I and II (B) II, IV, and V (C) II, III, and IV (D) I and IV (E) Not given
				6 & 12	Which of these figures is <u>not</u> divided by a line of symmetry?  (A) (B) (C) (D) (E) More than one of these
		b. Involving various geometrical shapes	Choosing correct pictorial representation	6 & 12	Which of these figures is <u>not</u> symmetrical?  (A) (B) (C) (D) (E) They are all symmetrical.
					Which figure is divided by a line of symmetry?  (A) (B) (C) (D) (E) None of these

8.3 ***Skill Area:*** Relationships Between Geometric Sets (Cont.)

8.32	Identify geometric congruency and similarity.	a. Same shape and size involving circles and quadrilaterals	Choosing correct pictorial representation	6 & 12	Which of these figures seem to have the same shape and size?  1 2 3 4 5 6 (A) 1, 6 (B) 2, 3 (C) 2,4 (D) 3,5 (E) 4, 5
		b. Same shape and size involving triangles	Choosing correct pictorial representation	6 & 12	 Which of these triangles seems to be congruent to the triangle above?  (A) (B) (C) (D) (E) Not given
		c. Congruency involving sides of a parallelogram	Choosing correct pictorial representation	6 & 12	In the diagram below, which segment seems to be congruent to $\overline{ST}$?  (A) $\overline{TQ}$ (B) $\overline{QR}$ (C) $\overline{RS}$ (D) $\overline{RT}$ (E) None of these
		d. Congruency involving semi-circles	Choosing correct pictorial representation	6 & 12	Which of the figures pictured below appear to be congruent?  I II III IV (A) I and IV only (B) II and III only (C) Both (A) and (B) are true (D) All four figures are congruent (E) None of the above

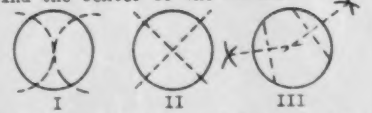
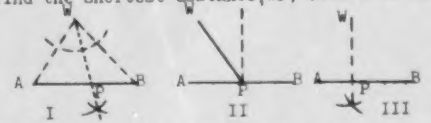
63

8.3 ***Skill Area:*** Relationships Between Geometric Sets (Cont.)

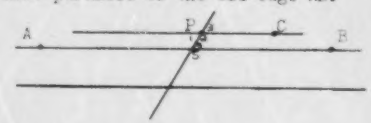
8.32 (Cont.)	Identify geometric congruency and similarity.	e. Congruency involving shape	Choosing correct pictorial representation	6 & 12	The symbol ~ means that two figures have the same shape but not necessarily the same size. In which of the following is the symbol ~ used correctly?  (E) None of these
		f. Congruency involving angles	Choosing correct pictorial representation	6 & 12	Which of the following angles is congruent to ∠ ABC? (A) ∠D and ∠E (B) ∠E and ∠F (C) ∠G and ∠H (D) ∠D, ∠E and ∠F (E) All of these

9.0 SUBCONTENT AREA: APPLICATIONS OF GEOMETRIC KNOWLEDGE OF FACTS AND CONCEPTS

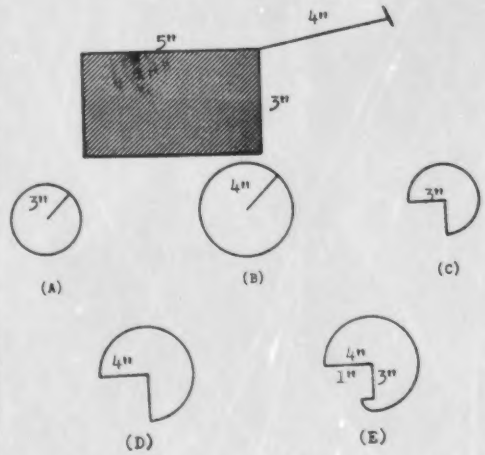
9.1 *Skill Area:* Point and Locus of Points

Level	*Subskill Area*	*Illustrative Item Specification*		*Grade Level*	*Example*
		Subskill	*Performance Mode*		
9.11	Determine point or sets of points that satisfy specified conditions.	a. Center of a rectangle using the diagonal intersection method	Choosing correct pictorial representation	6 & 12	Which drawing shows a good way to find the center of a rectangle? I II III (A) I (B) II (C) III (D) Not given
		b. Mid-point of a line segment by the perpendicular bisector method	Choosing correct pictorial representation	12	Given a segment, but <u>not</u> the midpoint of the segment, which drawing shows a good way to find the center of the circle?  I II III (A) I (B) II (C) III (D) None of these
		c. Shortest distance from a point to a line	Choosing correct pictorial representation	12	Given a point representing a water outlet, W and a line segment AB representing the side of a lawn, which drawing shows a good way to find the shortest distance, WP, from W to AB?  I II III (A) I (B) II (C) III (D) All of these (E) None of these

9.2 ***Skill Area:*** Geometric Properties and Relationships

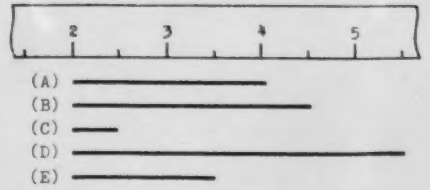
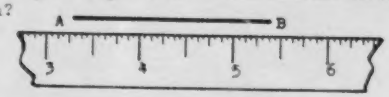
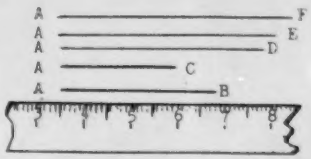
9.21	Translate word descriptions of physical situations in geometric terms and solve the word problem.	a. Involving characteristics of a triangle, rectangle, or circle	Choosing correct statement which means the same as the word description	12	A family wanted to lay out a 15 feet by 20 feet rectangular garden in their yard. To get a garden that was rectangular they: (A) Made sure two sides were 15 ft. long and two sides were 20 ft. long. (B) Made sure the two 15 ft. sides were parallel and the two 20 ft. sides were parallel. (C) Made sure that each diagonal of the 15 by 20 ft. figure was 25 ft. long. (D) Made sure that two opposite sides were 15 ft. long. (E) None of these.
		b. Involving characteristics of right similar triangles	Translating word problem into a geometric problem and solving	12	A tall cedar tree stood in the front yard of a home. At a certain time of day it was found that the tree cast a shadow of 20 ft., and a 10 ft. stick when held perpendicular to the ground cast a shadow of 5 ft. What is the approximate height of the cedar tree? (A) 40 ft. (B) 100 ft. (C) 50 ft. (D) 200 ft. (E) Not given
		c. Involving 3 noncollinear pts. determine a plane	Naming the solution for the word description	12	A boy wanted to build a small table. He noticed that many tables rocked when placed on a level floor. How many legs should be put on his table in order to be sure that his table will not rock? (A) 3 (B) 4 (C) 5 (D) 6 (E) None of these
		d. Involving properties of parallel lines	Naming the solution for the word description	12	A road builder wants to widen a road so that the new edge PC goes through point P and is also parallel to the old edge AB.  Which of these choices guarantees that AB and PC are parallel? (A) Angles 1 and 3 are equal in measure. (B) Angles 1 and 2 are equal in measure. (C) Angles 3 and 4 are equal in measure. (D) Angles 2 and 4 are equal in measure. (E) Angles 4 and 5 and equal in measure.

9.2 ***Skill Area:*** Geometric Properties and Relationships (Cont.)

9.21 (Cont.)	Translate word descriptions of physical situations to geometric terms.	b. Involving locus of a point	Choosing correct pictorial representation	6 & 12	One end of a string 4 inches long is tied to the corner of a rectangle of size 5 inches by 3 inches and the other end is tied to a marker. The region that can be traced by the marker, with the string kept tight and without going into the rectangle, is shaped like which of the following: 
9.22	Solve problems related to measurement of triangular or rectangular shapes.	a. Involving area of geometric shape	Solving the problem using geometric knowledge	12	The largest possible square piece is to be cut from a rug that is 8 feet by 10 feet. How many square feet in the remaining piece? (A) 2 (B) 16 (C) 20 (D) 80 (E) Not given

10.0 SUBCONTENT AREA: MEASUREMENT KNOWLEDGE

10.1 *Skill Area:* Estimation -- Length, Area, Capacity, and Conversion Factors

Level	*Subskill Area*	*Illustrative Item Specification*		*Grade Level*	*Example*
		Subskill	*Performance Mode*		
10.11	Determine the length of specified objects (U.S. Customary and SI metric systems).	a. To the nearest inch, $\frac{1}{2}$ inch, $\frac{1}{8}$ inch	Naming the length from pictorial representation	6	U.S. Customary System According to the ruler pictured below, which of these line segments is about 2½ units long?  How long is segment AB to the nearest half-inch?  (A) 2 (B) 3 (C) 3½ (D) 5½ (E) None of these
		b. To the nearest centimetre, half centimetre, or millimetre		6	SI Metric System  What is the length of AB to nearest half centimetre? (A) 1.5 cm (B) 2 cm (C) 2.5 cm (D) 3 cm (E) Not given What is the length of AC? (A) 2 cm (B) 3 cm (C) 2.5 cm (D) 2.6 cm (E) Not given

10.1 ***Skill Area:*** Estimation -- Length, Area, Capacity, and Conversion Factors (Cont.)

10.11 (Cont.)	Determine the length of specified objects (U.S. Customary and SI metric systems).	**b. To the nearest centimetre, half centimetre, or millimetre**	Naming the length from pictorial representation	6	What is the length of AD? (A) 4 cm (B) 4.1 cm (C) 4.2 cm (D) 4.5 cm (E) Not given What is the length of AE? (A) 4.8 cm (B) 4.9 cm (C) 5 cm (D) 5.1 cm (E) Not given What is the length of AF? (A) 5.0 cm (B) 5.6 cm (C) 5.7 cm (D) 5.8 cm (E) Not given
10.12	Estimate the length, breadth, height or capacity (U.S. Customary and SI metric systems).	a.To the nearest inch or ½ inch	Choosing "best" estimate of given pictorial representation	6 & 12	U.S. Customary System About how long is line segment XY? X _____ Y (A) 1 inch (B) 2 inches (C) 6 inches (D) 1 ft
		b.To the nearest centimetre			Metric System About how long is line segment XY? X _____ Y (A) 5 centimetres (B) 10 centimetres (C) 15 centimetres (D) 20 centimetres (E) 1 metre
		c.To the nearest $\frac{1}{8}$ inch	Choosing from given description of objects	6 & 12	U.S. Customary System Which of these is less than $\frac{1}{8}$ of an inch thick? (A) A piece of notebook paper (B) A door (C) A brick
		d.To the nearest millimetre			SI Metric System Which of these is less than one millimetre thick? (A) A piece of notebook paper (B) A door (C) A brick
10.13	Identify conversion factors for unit of length and its sub-units (U.S. Customary and SI metric systems).	a.Feet to inches and vice versa	Choosing the numeral	6 & 12	U.S. Customary System 1 foot is 12 inches 1 yard is 3 feet 1 mile is 5 280 feet

10.1 *Skill Area:* Estimation -- Length, Area, Capacity, and Conversion Factors (Cont.)

10.13 (Cont.)	Identify conversion factors for unit of length and its sub-units (U.S. Customary and SI metric systems).	a. Feet to inches and vice versa	Choosing the numeral	6 & 12	Change 6 feet to inches. (A) 18 in (B) 2 in (C) 72 in (D) ½ in Change 96 inches to feet. (A) 108 ft (B) 8 ft (C) 1 152 ft (D) $\frac{1}{8}$ ft
		b. Yards to feet and vice versa	Choosing the numeral	6 & 12	Change 5 yards to feet. (A) 8 ft (B) $\frac{3}{5}$ ft (C) 15 ft (D) $\frac{5}{3}$ ft (E) Not given Change 27 feet to yards. (A) 30 yds (B) 9 yds (C) $\frac{1}{3}$ yds (D) 81 yds
		c. Miles to feet or yards and vice versa	Choosing the numeral	6 & 12	Change 3 miles to yards. (A) 1 763 yds (B) 1 760 yds (C) 5 280 yds (D) $\frac{3}{1\ 760}$ Change 100 yards to miles. (A) 1 760 miles (B) 17.6 miles (C) 1 761 mile (D) $\frac{100}{1\ 760}$ yds
		d. Metric conversions involving kilometres, metres, decimetres centimetres, millimetres	Choosing the numeral	6 & 12	SI Metric System 1 centimetre is 10 millimetres 1 metre is 100 centimetres 1 kilometre is 1 000 metres Change 52 centimetres to millimetres. (A) 62 mm (B) 5.2 mm (C) 520 mm (D) $\frac{10}{52}$ mm Change 123 millimetres to centimetres. (A) 1.23 (B) 12.3 (C) 1 230 (D) 0.123
				6 & 12	Change 27 metres to centimetres. (A) 127 cm (B) 0.27 cm (C) 2 700 cm (D) $\frac{100}{27}$ cm (E) Not given Change 240 centimetres to metres. (A) 0.24 (B) 2.40 (C) 24.0 (D) 2 400
				6 & 12	Change 5 kilometres to metres. (A) 1 005 m (B) 0.005 m (C) 5 000 m (D) 200 m

10.1 *Skill Area:* Estimation -- Length, Area, Capacity, and Conversion Factors (Cont.)

10.13 (Cont.)	Identify conversion factors for unit of length and its subunits (U.S. Customary and SI metric systems).	d. Conversions involving decimetres, centimetres, millimetres, kilometres, metres	Choosing the numeral	6 & 12	Change 400 metres to kilometres. (A) 0.4 (B) 4.0 (C) 40.0 (D) 4 000
			Choosing which measure is less or greater than the other measure	6 & 12	If you change the unit of a measurement from a greater unit to a lesser unit, the new measure will always be [?] the original measure. (A) Less than (B) Equal to (C) Greater than (D) Not given If you change the unit of a measurement from a lesser unit to a greater unit, the new measure will always be [?] the original measure. (A) Less than (B) Equal to (D) Greater than (D) Not given
10.14	Identify conversion factors for unit of area and its subunits (U.S. Customary and SI metric systems).	a. Square feet to square inches or vice versa	Choosing the numeral	6 & 12	U.S. Customary System 1 square foot is 144 square inches 1 square yard is 9 square feet 1 square mile is 3 097 600 square yards Change 21 square feet to square inches. (A) 165 sq in (B) $\frac{48}{7}$ sq in (C) 3 024 sq in (D) $\frac{7}{48}$ sq in
		b. Square yards to square feet or vice versa	Choosing the numeral	6 & 12	Change 37 square yards to square feet. (A) 46 sq ft (B) $\frac{37}{9}$ sq ft (C) 333 sq ft (D) $\frac{9}{37}$ sq ft
		c. Square miles to square yards and vice versa	Choosing the numeral	12	Change 3.5 square miles to square yards. (A) 3 097 603.5 sq yd (B) 8 850 285.714 sq yd (C) 10 841 600 sq yd (D) 3 097 596.5 sq yd
					SI Metric System 1 square centimetre is 100 square millimetres 1 square metre is 10 000 square centimetres 1 square kilometre is 1 000 000 square metres
		d. Square centimetres to square millimetres or vice versa	Choosing the numeral	6 & 12	Change 21 square centimetres to square millimetres. (A) 2·100 (B) 210 (C) 2 100 (D) 21 000 (E) Not given
		e. Square metres to square centimetres or vice versa	Choosing the numeral	6 & 12	Change 37 square metres to square centimetres. (A) 370 000 (B) 3 700 (C) 370 (D) 0.37 (E) Not given

71

10.1 ***Skill Area:*** Estimation -- Length, Area, Capacity, and Conversion Factors (Cont.)

10.14 (Cont.)	Identify conversion factors for unit of area and its subunits (U.S. Customary and SI metric systems).	f. Square kilometres to square metres or vice versa	Choosing the numeral	12	Change 3.5 square kilometres to square metres. (A) 3 500 (B) 3 500 000 (C) 350 000 (D) 0.035 (E) Not given
10.15	Identify conversion factors for unit of weight and its subunits (U.S. Customary and SI metric systems).	a. Pounds to ounces and vice versa	Choosing the numeral	6 & 12	U.S. Customary System 1 pound is 16 ounces Change 5 pounds to ounces. (A) 21 oz (B) $\frac{16}{5}$ oz (C) 80 oz (D) $\frac{5}{16}$ oz (E) Not given Change 24 ounces to pounds. (A) 40 lbs (B) $\frac{2}{3}$ lbs (C) 384 lbs (D) $\frac{3}{2}$ lbs (E) Not given
		b. Tons to pounds and vice versa	Choosing the numeral	6 & 12	1 ton is 2000 pounds Change 17 tons to pounds. (A) 2017 lb (B) $\frac{2000}{17}$ lb (C) 34000 lb (D) $\frac{17}{2000}$ lb (E) Not given Change 4 280 pounds to tons. (A) 6280 t (B) $\frac{219}{100}$ t (C) 8560000 t (D) $\frac{100}{219}$ t (E) Not given
		c. Centigrams to milligrams and vice versa	Choosing the numeral	6 & 12	SI Metric System 1 centigram is 10 milligrams 1 gram is 100 centigrams 1 kilogram is 1 000 grams Change 5 centigrams to milligrams. (A) 0.5 (B) 50 (C) 500 (D) 5 000 (E) Not given Change 14 milligrams to centigrams. (A) 1 400 (B) 140 (C) 0.14 (D) 0.0014 (E) Not given
		d. Grams to centigrams and vice versa	Choosing the numeral	6 & 12	Change 17 grams to centigrams. (A) 0.017 (B) 0.17 (C) 1 700 (D) 170 000 (E) Not given

10.1 ***Skill Area:*** Estimation -- Length, Area, Capacity, and Conversion Factors (Cont.)

10.15 (Cont.)	Identify conversion factors for unit of weight and its subunits (U.S. Customary and SI metric systems).	i. Grams to centigrams and vice versa	Choosing the numeral	6 & 12	Change 347 centigrams to grams. (A) 0.347 (B) 3.47 (C) 3 470 (D) 34 700 (E) Not given
		j. Kilograms to grams and vice versa	Choosing the numeral	6 & 12	Change 23 kilograms to grams. (A) 0.023 (B) 0.23 (C) 2 300 (D) 23 000 (E) Not given Change 47 grams to kilograms. (A) 0.047 (B) 0.47 (C) 4 700 (D) 47 000 (E) Not given

10.2 ***Skill Area:*** Arithmetic Operation on Denominate Numbers

10.21	Determine the sum of two denominate numbers (U.S. Customary and SI metric systems).	a. Two or more denominate numbers involving mass, volume, or time	Naming the sum	6 & 12	U.S. Customary System Add: 22 ton 301 lbs +12 ton 908 lbs (A) 34 ton 1 199 lbs (B) 34 ton 392 lbs (C) 34 ton 1 209 lbs (D) 10 ton 392 lbs (E) Not given SI Metric System Add: 22 kg 301 g +12 kg 908 g (A) 34 kg 209 g (B) 35 kg 1 209 g (C) 35 kg 209 g (D) 35 kg 299 g (E) Not given English System Add: 3 days 18 hours 51 minutes +2 days 9 hours 16 minutes (A) 5 d 27 h 7 min (B) 6 d 3 h 7 min (C) 6 d 4 h 7 min (D) 1 week 27 h 7 min (E) 6 d 28 h 67 min Add: 3 hours 45 minutes 30 seconds +8 hours 15 minutes 25 seconds (A) 11 h 60 min 55 s (B) 12 h 0 min 55 s (C) 13 h 0 min 55 s (D) Not given

713

10.2 *Skill Area:* Arithmetic Operation on Denominate Numbers (Cont.)

10.22	Determine the difference of two denominate numbers (U.S. Customary and SI metric systems).	a. Two denominate numbers, involving mass, volume, time, or length	Naming differences	6 & 12	U.S. Customary System Subtract: 8 gal 2 qt -3 gal 1 qt (A) 4 gal 2 qt 1 pt (B) 5 gal 1 qt 1 pt (C) 5 gal 2 qt 1 pt (D) 6 gal 0 qt 1 pt (E) Not given SI Metric System Subtract: 8 litres 10 centilitres -3 litres 1 millilitre (A) 4 litres 10 centilitres 1 millilitre (B) 5 litres 0 centilitres 1 millilitre (C) 5 litres 10 centilitres 1 millilitre (D) 6 litres (E) Not given Subtract: 9 hours 13 minutes 10 seconds -6 hours 39 minutes 40 seconds (A) 2 h 33 min 30 s (B) 3 h 14 min 10 s (C) 3 h 26 min 30 s (D) Not given
10.23	Determine the product of a denominate number and a whole number (U.S. Customary and SI metric systems).	a. Involving renaming in product	Naming the product	6 & 12	Multiply: 2 days 5 hours 20 minutes x 4 (A) 8 d 20 h 80 min (B) 8 d 21 h 50 min (C) 10 d 1 h 20 min (D) Not given
10.24	Determine the quotient of a denominate number.	a. Involving renaming	Naming the quotient	6 & 12	Divide: 5)6 hours 45 minutes 20 seconds (A) 1 h 9 min 4 s (B) 1 h 21 min 4 s (C) 1 h 29 min 4 s (D) Not given

11.0 SUBCONTENT AREA: MEASUREMENT COMPREHENSION

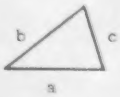
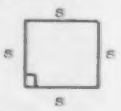
11.1 *Skill Area:* Estimation -- Length, Area, Capacity, and Mass

Level	*Subskill Area*	*Illustrative Item Specification*		*Grade Level*	*Example*
		Subskill	*Performance Mode*		
11.11	Determine an appropriate unit of measure for a given situation.	a. Involving unit of length	Naming unit of measure for verbal description of the situation	6 & 12	Choose the most appropriate unit of measure for measuring the width of a house: (A) miles (B) feet (C) millimetres (D) degrees (E) hours
		b. Involving unit of area	Naming unit of measure for verbal description of the situation	6 & 12	Choose the most appropriate unit of measure for measuring the area of the living room floor in a house in order to buy a carpet: (A) cubic yards (B) square inches (C) feet (D) square yards (E) Not given
		c. Involving unit of capacity	Naming unit of measure for verbal description of the situation	6 & 12	Choose the most appropriate unit of measure for measuring the capacity of a gas tank in a full-sized car: (A) quarts (B) square feet (C) gallons (D) pints (E) rods Choose the most appropriate unit of measure for recording the volume of air in a standard sized room: (A) ounces (B) square feet (C) cubic centimetres (D) gallons (E) cubic yards
		d. Involving unit of mass	Naming unit of measure for verbal description of the situation	6 & 12	Choose the most appropriate unit of measure for recording the growth in weight of a baby during the first ten days of life: (A) litres (B) ounces (C) inches (D) feet (E) pints
		e. Involving unit of an angle	Naming the unit of measure of an angle	6 & 12	An angle may be measured in units called: (A) grams (B) inches (C) litre (D) degree (E) Not given
11.12	Determine the property with which a number is associated in a given situation.	a. Labelling	Naming the property	6 & 12	Identify the use of the number in this statement: "George's football uniform number is 13." (A) A label (B) To show order (C) as a measure of quantity (D) Not given

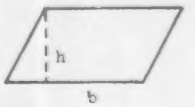
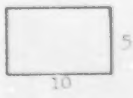
11.1 ***Skill Area:*** Estimation -- Length, Area, Capacity, and Mass (Cont.)

11.12 (Cont.)	Determine the property with which a number is associated in a given situation.	a. Labelling	Naming the property	6 & 12	Identify the use of the number in this sentence: "His telephone number is 694-2326." (A) A label (B) To show order (C) As a measure of quantity (D) Not given
		b. Quantifying	Naming the property	6 & 12	Identify the use of the number in this sentence: "The book has 502 pages." (A) A label (B) To show order (C) As a measure of quantity (D) Not given
		c. Ordering	Naming the property	6 & 12	Identify the use of the number in this sentence: "George was second in the race." (A) A label (B) To show order (C) As a measure of quantity (D) Not given
11.13	Determine relationship between unit of a measure and its subunits.	a. Involving feet and inches	Naming which unit is less or greater than the other unit	6 & 12	If you change 6 feet to inches, the new unit of length (the inch) is greater than, equal to, or less than the original unit (the foot). (A) Less than (B) Equal to (C) Greater than (D) Not given

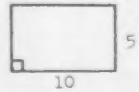
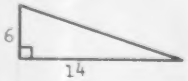
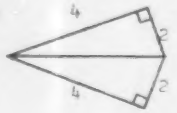
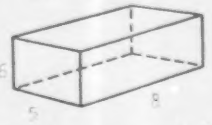
11.2 ***Skill Area:*** Measurement of Geometric Shapes

11.21	Identify formula for measurement of perimeter and area of geometric shapes.	a. Involving perimeter of a triangle	Providing the numerical value	6 & 12	The formula for the perimeter of this triangle is: (A) P=abc (B) P=a+b+c (C) P=3a 
		b. Involving perimeter of a square or rectangle		6 & 12	The formula for the perimeter of this figure is (A) P=4s (B) P=s+s (C) P= s+s 
		c. Involving area of a square or rectangle		6 & 12	The formula for the area of this figure is: (A) A=e+w (B) A=2e+2w (C) A=e•w

11.2 ***Skill Area:*** Measurement of Geometric Shapes (Cont.)

11.21 (Cont.)	Identify formula for measurement of perimeter and area of geometric shapes.	d. Involving area of a parallelogram	Naming the formula when the base and height are known	12	The formula for the base of this figure is: (A) A=b+h (B) A=b•h (C) A=½b•h (D) A=2b+2h (E) Not given 
		e. Involving area of a circle	Naming the formula when radius is known	12	The formula for the area of this figure is: (A) A=2πr (B) A=πd (C) A=$\frac{22}{7}$d (D) A=πr^2 (E) Not given
11.22	Compute the geometric measure from the given formula.	a. Involving arithmetic operations	Providing the numeric value	6	If P=2L + 2w, compute P when L is 16 and w is 4. (A) 20 (B) 40 (C) 36 (D) 44 If M=$\frac{a + b}{2}$, compute M when a is 5 and b is 13. (A) 130 (B) 32.5 (C) 4 (D) 9 If C=p + pt, compute C when p is .05 and t is 12. (A) 60.05 (B) 60.50 (C) 605 (D) .65
11.23	Compute the perimeter, area, or volume of a geometric shape.	a. Involving perimeter of a square shape	Naming the perimeter when length of a side is given	6 & 12	Compute the perimeter of this shape. (A) 8 (B) 16 (C) 4 (D) 2 (E) Not given
		b. Involving perimeter of a quadrilateral	Naming the perimeter when the length of two adjacent sides are given	6 & 12	Compute the perimeter of this region. (A) 30 (B) 2 500 (C) 50 (D) 15 (E) Not given 
		c. Involving perimeter of a circle	Naming the circumference when the radius or diameter is given	6 & 12	Compute the circumference of this region. ($\pi = \frac{22}{7}$) (A) $\frac{22}{7}$ x 7 (B) 2 x $\frac{22}{7}$ x 7 (C) $\frac{22}{7}$ x 7 x 7 (D) Not given
		d. Involving area of a square region	Naming the area when length of one side is given	6 & 12	Compute the area of this region. (A) 8 (B) 16 (C) 4 (D) 2 (E) Not given

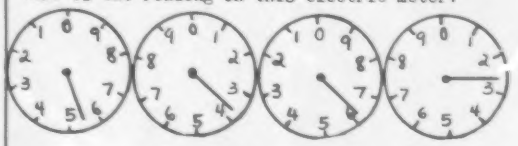
11.2 ***Skill Area:*** Measurement of Geometric Shapes (Cont.)

11.23 (Cont.)	Compute the perimeter, area, or volume of a geometric shape.	e. Involving area of a quadrilateral	Naming the area when the lengths of adjacent sides are given	12	Compute the area of this figure. (A) 30 (B) 2 500 (C) 50 (D) 15 (E) Not given 
		f. Involving area of a right triangle	Naming the area when the base and height are given	6 & 12	Compute the area of this figure. (A) 20 (B) 84 (C) 42 (D) 10 (E) Not given 
		g. Involving area of an obtuse triangle	Naming the area when the base and height are given	6 & 12	Compute the area of this figure. (A) 5 (B) 6 (C) 2 (D) 1.5 (E) Not given
		h. Involving area of two right triangles having common hypotenuse	Naming the area when the base and height are given	12	Compute the area of this figure. (A) 10 (B) 24 (C)16 (D) 5 (E) Not given 
		i. Involving area of a circle	Naming the area when the radius or diameter is given	6 & 12	Compute the area of this figure. ($\pi = \frac{22}{7}$) (A) $\frac{22}{7} \times 7$ (B) $2 \times \frac{22}{7} \times 7$ (C) $\frac{22}{7} \times 7 \times 7$ (D) Not given
		j. Involving volume of a rectangular solid	Naming the volume when the two sides and height are known	6 & 12	Compute the volume of this box. (A) 19 (B) 30 (C) 40 (D) 240 (E) 48 
		k. Involving volume of a cylinder	Naming the volume when the radius and height are known, given formula	12	Compute the volume of this cylinder. (Use $\pi = \frac{22}{7}$) (A) 17 (B) 39 (C) 1 540 (D) 220 (E) Not given
		l. Involving volume of a square solid	Naming the volume when one side is known	6 & 12	Compute the volume of this cube. (A) 9 (B) 27 (C) 3 (D) 12 (E) Not given

11.3 *Skill Area:* Functional Measurement

11.31	Measure the angle between two lines.	a. Involving graphical illustration; label the unit in standard terms	Naming the representation which has specified angle	6 & 12	Which of the following figures is most like an angle of 45°? (A) (B) (C) (D) (E) If angles A and B are the same size and if angle A measures 75 degrees, what is the measure of angle C? (A) 45° (B) 30° (C) 60° (D) 75° (E) Not given
		b. In context of hands of a clock	Naming the angle made by clock hands at specified time	6 & 12	The hands of a clock form a right angle at: (A) 12:00 o'clock (B) 2:30 o'clock (C) 3:15 o'clock (D) 6:00 o'clock (E) 9:00 o'clock
11.32	Read the measure in measuring instruments.	a. Involving Centigrade or Fahrenheit thermometer	Translating word problem into a mathematical equation and providing answer to the problem	6 & 12	Today the temperature was 63°. Yesterday it was 3° less. Which thermometer shows yesterday's temperature? (A) (B) (C) (D)

11.3 ***Skill Area:*** Functional Measurement (Cont.)

11.32 (Cont.)	Read the measure in measuring instruments.	b. Involving kilowatt hour electric meters	Translating word problem into a mathematical equation and providing answer to the problem	6 & 12	What is the reading on this electric meter?  Kilowatt Hours (A) 6 463 (B) 5 362 (C) 5 462 (D) 5 473 (E) Not given

C1

12.0 SUBCONTENT AREA: MEASUREMENT APPLICATIONS

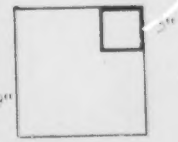
12.1 *Skill Area:* Arithmetic Operations on Denominate Numbers

Level	*Subskill Area*	*Illustrative Item Specification*		*Grade Level*	*Example*
		Subskill	*Performance Mode*		
12.11	Solve given word problem related to addition, subtraction, multiplication, division, or conversion of denominate numbers (U.S. Customary and SI metric systems).	a. Involving length and its units	Translating word problem into a mathematical equation and providing answer to the problem	6 & 12	U.S. Customary System If the perimeter of a rectangular figure is the sum of its sides, find the perimeter of the rectangular figure that has sides of 3.2 yards, 18.1 yards, 3.2 yards, and 18.1 yards: (A) 32.6 yards (B) 42.6 yards (C) 52.6 yards (D) 62.6 yards (E) Not given One day Dick jumped 13 feet 5 inches and Jim jumped 12 feet 8½ inches. How much longer was Dick's jump? (A) 6½ inches (B) 1 foot 6½ inches (C) 8½ inches (D) 9½ inches (E) 1 foot 5½ inches How many 8 inch award ribbons can be made out of a strip of material 160 inches long? (A) 19 (B) 20 (C) 21 (D) 22 (E) 23 A drawing of a room is made to the scale: $\frac{1}{8}$ inch to 1 foot If the length of the room in the drawing is $2\frac{3}{4}$ inches, what is the length, in feet, of the actual room? (A) $2\frac{1}{3}$ (B) $2\frac{5}{8}$ (C) 22 (D) 23 (E) Not given SI Metric System If the perimeter of a rectangular figure is the sum of the measures of its sides, find the perimeter of the rectangular figure that has sides 3.2 metres, 18.1 metres, 3.2 metres and 18.1 metres. (A) 32.6 metres (B) 42.6 metres (C) 52.6 metres (D) 62.6 metres (E) Not given

12.1 ***Skill Area:*** Arithmetic Operations on Denominate Numbers (Cont.)

12.11 (Cont.)	Solve given word problem related to addition, subtraction, multiplication, division, or conversion of denominate numbers (U.S. Customary and SI metric systems).	b. Involving length/perimeter	Translating word problem into a mathematical equation and providing answer to the problem	6 & 12	One day Dick jumped 4.2 metres and Jim jumped 3.9 metres. How much longer was Dick's jump? (A) 25 centimetres (B) 30 centimetres (C) 35 centimetres (D) 29 centimetres (E) Not given How many 21 centimetre ribbons can be made out of a strip of material 420 centimetres long? (A) 19 (B) 20 (C) 21 (D) 22 (E) 23 A drawing of a room is made to the scale: 5 centimetres to 1 metre If the length of the room in the drawing is 35 centimetres, what is the length, in metres, of the room? (A) 35 metres (B) 20 metres (C) 7 metres (D) 5 metres (E) Not given
		c. Involving area and its units	Translating word problem into mathematical equation and providing answer to the problem	6 & 12	<u>U.S. Customary System</u> What is the area in square feet of a rectangular room whose sides are $12\frac{3}{4}$ feet and 15 feet long? (A) $27\frac{3}{4}$ (B) $55\frac{1}{2}$ (C) $180\frac{3}{4}$ (D) $191\frac{1}{4}$ (E) Not given Find the number of square yards of carpet needed to cover the floor of a room 5 yards by 7 yards if the room is rectangular in shape. (A) 12 (B) 35 (C) 2 (D) 24 (E) Not given 1 square yard is 9 square feet. Find the number of square yards of carpet needed to cover a rectangular room 12 feet by 30 feet. (A) 42 (B) 360 (C) 40 (D) 84 (E) Not given <u>SI Metric System</u> What is the area : square metres of a rectangular room whose sides are 12.75 metres wide and 15 metres long? (A) 27.75 (B) 55.5 (C) 180.75 (D) 191.25 (E) Not given

12.1 ***Skill Area:*** Arithmetic Operations on Denominate Numbers (Cont.)

12.11 (Cont.)	Solve given word problem related to addition, subtraction, multiplication, division, or conversion of denominate numbers (U.S. Customary and SI metric systems).	c. Involving area and its units	Translating word problem into mathematical equation and providing answer to the problem	6 & 12	1 square metre is 100 square decimetres. Find the number of square metres of carpet needed to cover the floor of a room 5 metres by 7 metres if the room is rectangular in shape. (A) 12 (B) 35 (C) 2 (D) 24 (E) Not given Find the number of square metres of carpet needed to cover a rectangular room 48 decimetres by 120 decimetres. (A) 168 (B) 57.6 (C) 16.8 (D) 33.6 (E) Not given
		d. Involving graphical description of area	Translating word problem as a mathematical sentence and providing answer to the problem	12	The area in the region bounded by the closed curve in the figure to the right is: (A) Between 6 and 7 sq units (B) Between 12 and 32 sq units (C) Between 7 and 12 sq units (D) Between 35 and 42 sq units (E) Exactly 23½ sq units Suppose we know that the altitude h of a triangle is between 4 and 6 ($4<h<6$) and also that the base b is between 8 and 10 ($8<b<10$). Which of the following do we know to be true about the area A? (A) $16<A<30$ (B) $32<A<45$ (C) $40<A<48$ (D) $45<A<60$ (E) $32<A<60$ The area of the large square is how many times as large as the area of the small square? (A) 3 (B) 6 (C) 9 (D) 12 (E) None of these 
		e. Involving capacity and its units	Translating word problem into a mathematical equation and providing answer to the problem	6 & 12	U.S. Customary System 1 quart is 2 pints. 1 gallon is 4 quarts. The sum of 2 gallons, 3 quarts, 1 pint, and 3 gallons, 1 pint is: (A) 5 gallons 1 pint (B) 6 gallons 1 pint (C) 5 gallons 3 quarts 1 pint (D) 6 gallons (E) 6 gallons 3 quarts 1 pint

12.1 ***Skill Area:*** Arithmetic Operations on Denominate Numbers (Cont.)

12.11 (Cont.)	Solve given word problem related to addition, subtraction, multiplication, division, or conversion of denominate numbers (U.S. Customary and SI metric systems).	e. Involving capacity and its units	Translating word problem into a mathematical equation and providing answer to the problem	6 & 12	One tank holds 2 gallons, another holds 6 quarts, and a third tank holds 7 pints. Together, how much can all three hold? (A) 15 quarts (B) 3 gal, 3 qts, 3 pts (C) 3 gal 1 qt, 1 pt (D) 4 gal, 1 pt (E) 4 gal, 1 qt, 1 pt SI Metric System 1 centilitre is 10 millilitres 1 decilitre is 10 centilitres 1 litre is 10 decilitres The sum of 2 litres, 4 centilitres, 6 millilitres, and 3 litres, 7 millilitres is: (A) 5.043 litres (B) 5.05 litres (C) 6.04 litres (D) 5.053 litres (E) Not given One tank holds 2 litres, another holds 16 decilitres, and another holds 13 centilitres. Together, how much can all three hold? (A) 2.29 litres (B) 2.129 litres (C) 2.146 litres (D) 2.173 litres (E) Not given
		f. Involving time and its units and rate	Translating word problem into a mathematical equation and providing answer to the problem	6 & 12	U.S. Customary System A century is 100 years and a decade is 10 years. How many years are there in three centuries and 2½ decades? (A) 370 (B) 325 (C) 330 (D) 550 (E) 320 If an airplane can average 450 miles an hour, how long will it take the plane to fly 1800 miles? (A) 3 hrs (B) 4½ hrs (C) 4 hrs (D) 5 hrs (E) 3½ hrs How many hours and minutes will it take Dave to travel from Bakersfield to Sacramento if he travels at an average rate of 60 miles per hour and the distance is 276 miles? (A) 4 hrs 20 min (B) 4 hrs 30 min (C) 4 hrs 36 min (D) 4 hrs 26 min (E) 4 hrs 18 min

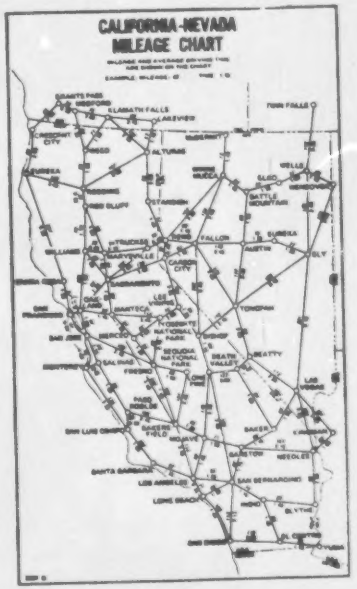
12.1 *Skill Area:* Arithmetic Operations on Denominate Numbers (Cont.)

12.11 (Cont.)	Solve given word problem related to addition, subtraction, multiplication, division, or conversion of denominate numbers (U.S. Customary and SI metric systems).	f. Involving time and its units and rate	Translating word problem into a mathematical equation and providing answer to the problem	6 & 12	A turkey weighs 14 pounds. A turkey this size should be roasted for at least 20 minutes per pound. Which of the following is the best time to <u>start</u> roasting this turkey in order to have dinner ready by 6 p.m? (A) 1 p.m. (B) 2 p.m. (C) 3 p.m. (D) 4 p.m. (E) 5 p.m. <u>SI Metric System</u> If an airplane can average 729 kilometres an hour, then how long will it take the plane to fly 2 916 kilometres? (A) 3 hrs (B) 4½ hrs (C) 4 hrs (D) 5 hrs (E) 3½ hrs How many hours and minutes will it take Dave to travel from Bakersfield to Sacramento if he travels at an average rate of 95 kilometres per hour and the distance is 437 kilometres? (A) 4 hrs 20 min (B) 4 hrs 30 min (C) 4 hrs 36 min (D) 4 hrs 26 min (E) 4 hrs 18 min A turkey weighs 7 kilograms. A turkey this size should be roasted for at least 40 minutes per kilogram. Which of the following is the best time to <u>start</u> roasting this turkey in order to have dinner ready by 6 p.m.? (A) 1 p.m. (B) 2 p.m. (C) 3 p.m. (D) 4 p.m. (E) 5 p.m.
		g. Involving weight and its units	Translating word problem as a mathematical sentence and providing answer to the problem	6 & 12	<u>U.S. Customary System</u> 1 pound is 16 ounces Three heads of lettuce separately weighed 1 lb. 2 oz, 11 oz, and 19 oz. Together, they weighed: (A) 3 lbs (B) 2 lbs 32 oz (C) 33 oz (D) 2 lbs 12 oz (E) None of these <u>SI Metric System</u> 1 gram is 10 decigrams. If the respective weights of three blocks of metal were 9 decigrams, 8 grams, and 5 decigrams how much do they weigh togetner? (A) 9.4 grams (B) 8.5 grams (C) 22 grams (D) 22 decigrams (E) Not given

12.1 ***Skill Area:*** Arithmetic Operations on Denominate Numbers (Cont.)

12.12	Solve word problems related to maps.	a. Involving mileage charts or maps	Computing the distance between two places or identifying a place which is a certain distance from another place	6 & 12	Home — Blue Lake — Summer Cabin T R S X Y 0 1 2 3 4 5 6 7 8 9 10 11 12 Place — Miles from Home Home 0 Gas Station 1 Blue Lake 4 Rainbow Falls 5 Picnic Grounds 8 Summer Cabin 11 The picnic grounds are at what letter? (A) T (B) R (C) S (D) X (E) Y How far is it from Blue Lake to Summer Cabin? (A) 11 miles (B) 8 miles (C) 7 miles (D) 6 miles (E) 4 miles Rainbow Falls is two miles before Bass Lake. At what point on the line is Bass Lake? (A) S (B) Y (C) X (D) R (E) T

12.1 ***Skill Area:*** Arithmetic Operations on Denominate Numbers (Cont.)

12.12 (Cont.)	Solve word problems related to maps.	a. Involving mileage charts or maps	Computing the distance between two places or identifying a place which is a certain distance from another place	6 & 12	 What is the shortest distance from Monterey to Santa Barbara, as shown on the map? (A) 243 (B) 136 (C) 107 (D) 252 (E) 205 What city is shown to be 60 miles from Sacramento? (A) Williams (B) Oakland (C) Manteca (D) Marysville (E) Truckee

13.0 SUBCONTENT AREA: PROBABILITY AND STATISTICS–COMPUTATION AND KNOWLEDGE OF FACTS

13.1 *Skill Area:* Probability

Level	*Subskill Area*	*Illustrative Item Specifications*		*Grade Level*	*Example*
		Subskill	*Performance Mode*		
13.11	Identify limits on value of probability of an event.	a. Involving events certain to occur	Given the statement of fact, choosing the probability	6 & 12	If an event is certain to occur, then the probability of that event is: (A) $\frac{1}{2}$ (B) 100 (C) 1 (D) 0 (E) **None of these**
		b. Involving events certain not to occur	Given the statement of fact, choosing the probability	6 & 12	If an event is certain <u>not</u> to occur, then the probability of that event is: (A) -1 (B) 100 (C) 1 (D) 0 (E) **None of these**
		c. Involving a simple event	Given the statement of fact, choosing the probability	12	The probability of any event occurring is: (A) Greater than 1 (B) Greater than or equal to 100 (C) Greater than or equal to zero and less than or equal to 1 (D) Less than zero (E) None of these

13.2 *Skill Area:* Statistics

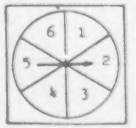
13.21	Determine mean or average of a data set.	a. Involving 10 or fewer data	Naming the statistic	6 & 12	Three boys score an average of two runs each in a baseball game. How many runs do they score in all? (A) 2 (B) 3 (C) 4 (D) 5 (E) 6 What is the average of the following five numbers: 3, 2, 5, 6, 4 (A) 4 (B) 5 (C) 6 (D) 10 (E) 20
13.22	Determine mode and median of a data set.	a. Involving 10 or fewer data	Naming the statistic	12	Consider the following data set: 68, 75, 75, 77, 80, 86, 86, 86, 95, 100 What is the mode of the data? (A) 32 (B) 42 (C) 86 (D) 100 (E) None of these What is the median of the distribution? (A) 80 (B) 82.8 (C) 83 (D) 86 (E) None of these

13.2 ***Skill Area:*** Statistics (Cont.)

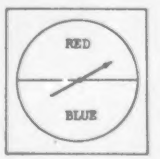
13.22 (Cont.)	Determine range of a data set.	b. Involving 10 or fewer data	Naming the statistic	6 & 12	Consider the following data set: 68, 75, 75, 77, 80, 86, 95, 100 What is the range of the data? (A) 32 (B) 42 (C) 68 (D) 100 (E) None of these

14.0 SUBCONTENT AREA: PROBABILITY AND STATISTICS–COMPREHENSION

14.1 *Skill Area:* Probability of Simple Event

Level	*Subskill Area*	*Illustrative Item Specification*		*Grade Level*	*Example*
		Subskill	*Performance Mode*		
14.11	Determine the probability of an event or vice versa.	a. Involving events certain or not certain to occur	Naming probability of an event described in words	6	If the marbles in a box are all blue, the probability of picking a red marble is: (A) one (B) one-half (C) zero (D) uncertain (E) None of these
			Making a determination when the probability is given	6	If the probability of picking a red shirt out of a drawer is equal to one, which of these statements must be true? (A) The shirts might all be blue. (B) Some of the shirts are red, and some are blue. (C) There are three different colors of shirts in the drawer. (D) All the shirts are red. (E) You cannot be sure of the colors.
		b. Involving simple events	Determining the probability of an event or model	6	The face of this spinner is divided into 6 equal regions. What is the probability that the pointer will stop on Region 5 if you spin it one time? (A) 0 (B) $\frac{1}{6}$ (C) $\frac{1}{3}$ (D) $\frac{1}{5}$ (E) 1 
				6	The teacher wrote 1, 2, 3, 4, 5, 6 on the chalkboard. She said, "I am thinking of these numbers." What is the probability that she is thinking of an even number? (A) 1 (B) $\frac{1}{6}$ (C) $\frac{1}{2}$ (D) $\frac{1}{3}$ (E) None of these
				6 & 12	Fred has 6 identical marbles, except for color, in his pocket; 3 are red and 3 are white. If he removes one marble, what are the chances that it will be a red one? (A) 1 chance in 6 (B) 1 chance in 3 (C) 1 chance in 2 (D) 3 chances in 3 (E) None of these

14.1 ***Skill Area:*** Probability of Simple Event (Cont.)

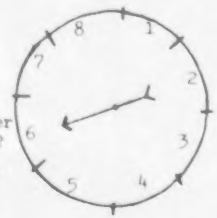
14.11 (Cont.)	Determine the probability of an event or vice versa.	b. Involving simple events	Determining the probability of an event or model	6 & 12	A bowl contains 6 identical marbles, except for color. One is a white marble, two are red marbles, and three are blue marbles. If you were blindfolded and then removed one marble from the bowl, what is the probability that the marble you removed would be red? (A) 0 (B) $\frac{1}{3}$ (C) $\frac{1}{2}$ (D) $\frac{2}{3}$ (E) None of these
			Describing the event when the probability of an event is given	12	The pointer on the fair spinner at the right has stopped on the red ten times in a row. On the next spin: (A) Red is less likely than blue. (B) Red is more likely than blue. (C) Red and blue are equally likely. (D) Red is certain. (E) Red is impossible.  If the probability of red on a fair spinner is equal to one, which of the following statements must be true? (A) The dial might be colored blue. (B) The dial could have 2 colors. (C) The dial could have 3 colors. (D) The dial is all red. (E) You cannot be sure of the colors.
14.12	Determine the probability of the complement of an event.	a. The probability of the event given in percentage	Determining the probability word description of an event when a certain condition is given	6	If the probability of rain is 70 percent, then what is the probability that it will not rain? (A) 10% (B) 30% (C) 70% (D) 30 to 1 (E) 70 to 1
		b. Involving simple events	Determining the probability of an event or model when certain factors are given	12*	A bag contains 12 identical marbles of different colors. If you remove one marble without looking in the bag, your chances of picking a red one is equal to ¼. What is the chance that it will not be red? (A) $\frac{1}{4}$ (B) $\frac{1}{2}$ (C) $\frac{4}{12}$ (D) $\frac{3}{4}$ (E) Cannot be determined
			Forecasting or determining probability of an event	12*	A weather report states that the probability of rain is 70 percent. What is the probability that it will not rain? (A) $\frac{70}{100}$ (B) $\frac{7}{10}$ (C) $\frac{30}{70}$ (D) $\frac{3}{10}$ (E) None of these

* Not included in the 1973-74 version of the Survey of Basic Skills.

91

15.0 SUBCONTENT AREA: PROBABILITY AND STATISTICS–APPLICATIONS

15.1 *Skill Area:* Probability

Level	*Subskill Area*	*Illustrative Item Specifications*		*Grade Level*	*Example*
		Subskill	*Performance Mode*		
15.11	Determine the probability of a simple event described in words.	a. Involving problems encountered in daily life situations	Translate word problem into a mathematical expression or equation and solving the equation	6	The batting average of a baseball player is .333. Using this number as a measure of chance, what is the probability that this man will make a hit the next time he is at bat? (A) $\frac{333}{1\,000}$ (B) $\frac{1}{2}$ (C) 1 (D) $\frac{1\,000}{333}$ (E) 0
				6	The record of a weather station shows that in the past 120 days its weather predictions have been correct for 89 of the 120 days. Using this information, what is the probability that its prediction for tomorrow will be correct? (A) $\frac{120}{89}$ (B) 1 (C) $\frac{89}{120}$ (D) 0 (E) $\frac{1}{2}$
				6 & 12*	A manufacturer of pencil sharpeners tests carefully a sample of 500 sharpeners to see if a pencil of a certain type can be sharpened without breaking the point. In the test 489 of the tested sharpeners worked satisfactorily. There were 20 000 sharpeners in this job lot. What is the probability that a sharpener selected at random from the remaining 19 500 sharpeners will perform satisfactorily? (A) $\frac{489}{19\,500}$ (B) $\frac{489}{500}$ (C) $\frac{500}{19\,500}$ (D) $\frac{19\,500}{489}$ (E) Not given
		b. Involving a spinner	Naming the probability of the event described	12	On a dial the numbers 1 through 8 are spaced equally around the dial. What is the probability that a fair spinning pointer will stop at an odd number? (A) $\frac{1}{8}$ (B) $\frac{1}{2}$ (C) $\frac{1}{4}$ (D) $\frac{1}{3}$ (E) None of these 

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15.1 ***Skill Area:*** Probability (Cont.)

15.12	Determine the probability of the union of two mutually exclusive events described in words.	a. Involving rolling of a fair die	Providing the probability	12*	What is the probability of obtaining a 6 or a 1 on one roll of the fair die? (A) $\frac{1}{2}$ (B) $\frac{1}{6}$ (C) $\frac{1}{4}$ (D) $\frac{1}{3}$ (E) None of these
		b. Involving problems encountered in daily life situations	Providing the probability	12*	In a neighborhood pet show there are ten dogs, eight cats, three canaries, and six rabbits. A special prize was given to the owner of a pet by drawing one owner's name from the entry slips. What is the probability that the prize winner will be the owner of a dog or cat? (A) $\frac{10}{27}$ (B) $\frac{8}{27}$ (C) $\frac{1}{2}$ (D) $\frac{2}{3}$ (E) None of these
15.13	Determine the probability of the intersection of two or three events described in words.	a. Involving tossing a coin	Providing the probability	12*	You toss a coin twice in succession. Let A be the event that a tail shows on the first toss of the coin. Let B be the event that a head shows on the second toss. Find the probability that the coin will show heads on both tosses. (A) $\frac{1}{2}$ (B) $\frac{1}{4}$ (C) 1 (D) $\frac{1}{3}$ (E) None of these
		b. Involving problems encountered in daily life situations	Providing the probability	12*	A baseball team is to play team A and team B on two successive dates. It is estimated that the probability of winning over A is ½ and over B is 2/5. What is the probability of the team winning both games? (A) $\frac{9}{10}$ (B) $\frac{1}{5}$ (C) $\frac{1}{2}$ (D) $\frac{2}{5}$ (E) None of these

15.2 ***Skill Area:*** Statistics

15.21	Determine the mean, range, and sum of data points from information given in a word problem.	a. Involving daily life situations, 6 or fewer data points	Solving the word problem	12	A family spent an average of $46 per month on food for a 2-month period. If food cost the family $39 for the first month, how much did the family spend on food the other month? (A) $32 (B) $53 (C) $42.50 (D) $60 (E) $4950 In a marking period, Nancy had test scores of 78, 76, 74, while Tom had scores of 72, 82, 74. How did Nancy's average compare with Tom's? (A) Nancy's average was 1 point higher. (B) Nancy's average was 1 point lower. (C) Both averages were the same. (D) Nancy's average was 2 points higher. (E) Nancy's average was 2 points lower.

* Not included in the 1973-74 version of the Survey of Basic Skills.

15.2 ***Skill Area:*** Statistics (Cont.)

15.21 (Cont.)	Determine the mean, range, and sum of data points from information given in a word problem.	a. Involving daily life situations, 6 or fewer data points	Solving the word problem	12	A new drive-in theater has just been built. The manager is interested in gathering information about his new theater. To get some idea of the average number of passengers per car, the manager made the following tabulation of the number of passengers in every other car on opening night. No. of Passengers per Car / No. of Cars 1 / 100 2 / 300 3 / 400 4 / 200 For these 1 000 cars, what was the average number of persons per car? (A) 1.0 (B) 2.0 (C) 2.5 (D) 2.7 (E) 3.0
				12	On opening night a total of 2 000 cars entered a drive-in movie theater, but the manager kept track of only 1 000 cars. For these 1 000 cars the average number of persons per car was 2.7. The manager wants to estimate the average number of passengers per car for the entire 2 000 cars. Which of the following statements is the most sensible? (A) The best estimate for all 2 000 cars is half of 2.7. (B) The best estimate is twice 2.7. (C) The best estimate is 2.7. (D) The best estimate is 3. (E) No estimate is reasonable.
				12*	A random sample of 10% of the 1 000 labor union members in the city were asked whether or not they favored the proposed merger of two unions; 80% of the sample were in favor of the merger. Which of the following conclusions is valid? I 80% of all union members in the city are in favor of the merger. II At least 8% of all union members in the city are in favor of the merger. III It is probable that a majority of all union members in the city is in favor of the merger. (A) Only I (B) Only II (C) Only III (D) Only II and III (E) I, II and III

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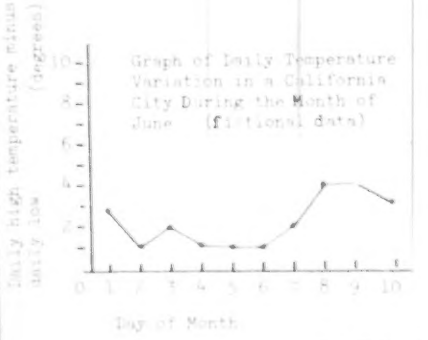
15.2 *Skill Area:* Statistics (Cont.)

15.21 (Cont.)	Determine the mean, range, and sum of data points from information given in a word problem.	a. Involving daily life situations, 6 or fewer data points	Solving the word problem	12*	Two organizations were preparing predictions about a local election. Agency A interviewed a random sample of 900 from the lists of registered voters in the city. Agency B conducted telephone interviews with a random sample of 1 000 from the city telephone directory. If the statistical methods of the organizations were otherwise identical, which of the following is the best statement concerning the two predictions? (A) Agency A's prediction is better because it interviewed registered voters. (B) Agency B's prediction is better because the telephone directory gives a better cross section of the population. (C) Agency B's prediction is better because its sample is larger. (D) Agency B's prediction is better because telephone interviews are more accurate. (E) The predictions are equally good. Use the following graph to select the best statement: (A) The graph indicates that it was warm during the first ten days in June. (B) The graph indicates that it was hot all day on the 8th of June. (C) The graph indicates that the maximum temperature on the 8th and 9th days were the same. (D) The graph indicates that there was little variation in temperature during the day for each of the 10 days tabulated. (E) The graph indicates that the highest temperature during the ten-day period is four degrees higher than the lowest temperature during the ten-day period.  Graph of Daily Temperature Variation in a California City During the Month of June (fictional data) 80065 300 12-75 TM OSP

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